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NOTWITHSTANDING the intense heat that has served to demoralize some branches of trade, the electrical industries have all maintained great activity during the summer, especially the important and leading departments of light and power. The interest generally taken in the meeting of the National Electric Light Association at Boston a few days hence is a sign of the attention now being paid everywhere to the lighting business, and an article on the next page furnishes some striking data as to the growth already experienced in the new motor field. Even this stage of a development that has been unparalleled in its rapidity and magnitude promises no finality, but, on the contrary, it appears like the threshold of a new era, in which scores of novel ideas and inventions await trial and use. To keep pace with this onrush is not an easy task for the electrician who wishes to make himself informed on all details of his science and art; while to present with regularity, precision and accuracy a full and fair record of what is being said and done has become, it may be freely owned, an occupation of no mean difficulty. Probably the best way to learn how progressive an art is and how intelligent are its practitioners, is to note the style and contents of its representative journals; and, if it be not overstepping the bounds of modesty, we would like to suggest that the present status of electrical research and application is well exemplified in our own columns. THE ELECTRICAL WORLD grew with the telegraph; it found new opportunities of usefulness when the telephone came into service; and the successful exploitation of the electric light increased tenfold its range of circulation and support. To-day, in the success of the storage battery and the motor, it sees again the triumph of apparatus whose merit it insisted upon even though that pioneer work had then nothing to sustain it but enthusiasm and an abiding faith in the capability of electrical applications, when perfected, to meet every demand made upon them. Such a journal as THE ELECTRICAL WORLD has been these many years it intends to be still, strong not only in its own determination to maintain a high standard of excellence, but strong also in the encouragement of those who appreciate the worth of work done honestly for the common good, with allegiance to no interest but that of every one whom it reaches. As in political economy the greatest good of the largest number is to be sought, so in legitimate journalism the intelligent good will of the largest number of readers is the main thing; and that earned, few other points need be considered. We think we may refer to our present issue of 44 pages as a sufficient evidence of the manner in which the ability of THE ELECTRICAL WORLD to "cover the field" is recognized and approved in every quarter by new friends as well as old.

A PARAGRAPH appearing in another part of this issue gives a new version of the famous and futile "B. & O deal." It now appears that Mr. Garrett was wholly averse to the acquisition of his telegraph system by the Western Union Company, and that he frustrated the intentions of Mr. Ives in this respect by completely breaking off the negotiations that had begun and had been so much berumored.

THE meeting of the National Electric Light Association which begins at the Parker House, Boston, next Tuesday, seems likely to be of the most interesting and important nature. There are many vital questions to come before it for consideration and discussion, and there will be brought to bear upon them the practical, sound common sense, wide experience and technical expertness that have marked the conventions gone by.

REPORTS from the Lykens Valley coal mine, near Wilkesbarre, tell of the successful introduction of electric motors there for coal haulage. This is a field of work in which the electric motor should find ready and ample occupation. All that has been wanted is the demonstration of practicability, and that is now afforded. Although there are some unusual difficulties to overcome, there are a great many advantages to be enjoyed with such a service.

THE novel method of coupling dynamo and engine devised by Professors Ayrton and Perry, described this week, seems to be destined to a widespread application, not only on board ship, but also in many other situations where space is valuable. The methods heretofore employed to overcome the use of long belts have consisted chiefly in the employment of toothed and friction gearing. Both of these methods, however, involve an objectionable loss of power due to friction, and the method tried by Ayrton and Perry, which obviates the difficulty is both practical and timely. The theory involved in this method of gearing is quite simple. It consists merely in obtaining the necessary tension of the belt by a pressure which, instead of being transmitted to the bearing of the machine, is balanced by the increased weight of the pulley.

THE prospects of electric lighting in Europe are brighter than they have been for some time. There is a demand for apparatus in Spain, activity prevails in Austria, some large installations are progressing in England, while in the land of the "unspeakable Turk" a "powerful syndicate" has been formed to push electric lighting, beginning with a fifty years' monopoly in Constantinople. In England, especially, important work is ahead; and we judge, from the stray accounts of the work being done at Leamington, that the plant there will be an unusually large one. It is high time that England had several central electric lighting stations, and their construction is evidently nearer at hand than seemed possible a few months ago.

WHILE double-track railroads make the duties of the train dispatcher comparatively light, the importance which the telegraph occupies in the operation of single-track railroads is manifest. In both cases, however, an interruption in the telegraphic communication between the dispatcher's office and the intermediate stations always means loss of time, confusion, danger and, not infrequently, accident. Again, the forgetfulness of operators in leaving their keys open when called away to other business is a frequent cause of annoyance and trouble. A telegraph system by which a break in the circuit, whether at the key or on the line, still leaves the circuit in a position to handle business is, therefore, most desirable. The description of Mr. Robbins' system on another page, by which this is effected, will therefore be of special interest to railway superintendents as well as many others.

IN the description of a dynamo of foreign design which appeared in our columns a short while ago attention was drawn to the fact that greater efficiency had been obtained by entirely surrounding the armature wires with iron, and in the case referred to this was accomplished by passing the wires through holes in the iron near the periphery. It was pointed out that the attempts to bring the iron of armature and field into close proxity by means of tooth armatures had in some cases led to irregular action in the machine, due to the constant distortion of the field. In the six-pole armature first employed by Mr. Silvey, as mentioned elsewhere, this same action was manifested; but by the expedient employed, viz., the wrapping of the wires with a sufficient thickness of soft iron, the inequalities of the magnetic circuit were smoothed over and not only the sparking at the commutator removed, but the output of the machine considerably increased. The effect of the wrapping was evidently equal to the insertion of the wire within the body of a solid mass of iron as practiced in the first case. The rules arrived at by Mr. Silvey for obtaining the best results in dynamo construction, though not all new, are interesting as being the result of actual experiment.

ONE of the most curious cases of the action and reaction of one industry upon another is brought out in the article we quote on the relation between the electric motor and the small steam engine. Mr. W. H. Hoffman, a steam engineer of acknowledged ability, shows by unassailable evidence, that unless the present method of building small steam engines is greatly improved their field of operation will be limited to those places where it is impossible to convey an electric current. It is significant, indeed, that users of power are willing to pay as high as three times the cost of a steam engine for a machine of no greater power, but one which will do its work at a far greater economy. We recall the vast improvements necessitated in the regulating power of steam engines upon the advent of electric lighting, and if Mr. Hoffman's advice to builders of small steam engines is heeded we may now also expect to see the direct influence of the electric motor on the steam engine industry. Looking at the question squarely, however, we are inclined to the belief that, though it is without doubt practical to increase the present economy, or rather decrease the waste, of the ordinary small steam engine of to-day, the gain effected will never be sufficient to completely offset the advantages of the electric motor. Granted that small isolated steam engines can be made to use no more steam per horse power per hour than the large ones at the central electric light station, (which is improbable), and deducting the loss due to two conversions, those in the dynamo and the motor, we have this outbalanced by the cost of attendance on the steam engine and boiler, without considering the question of *convenience*; and when this latter point is counted in it will not be difficult to decide upon the adoption of the new motive power. The facts presented in another column regarding the spreading use of the electric motor are sufficient proof of the correctness of the stand we have maintained in this matter, and while we should be glad to see and expect to see improvements effected in the small engines, we know that the ground won by the electric motor will be made more and more secure.

Electrical Determination of "Humidity."

BY LEOPOLD WEIL.

We hear much of late in the daily papers about the *humidity* of the atmosphere, and we are sometimes informed that it is as high as 97 per cent. I would suggest that a very good method of determining the quantity or percentage of moisture in the atmosphere, by the aid of electricity, would be to employ an electric hydrostat; the same consists of a conductor 3 × 3 inches, upon which is placed a piece of blotting paper plain or impregnated with a solution which would increase the conductivity. Over this and pressing upon the paper are placed wires ¼ inch apart, running in one direction only. If we connect this hydrostat in circuit with a measuring instrument, it is obvious that when the paper is dry no current will pass, but if exposed to the atmosphere it will absorb the humidity and the ratio of current passing will be in equal proportions to the amount of moisture absorbed, and this will be shown on the measuring instrument.

Electric Power Service.

BY T. C. MARTIN.

The rapid introduction of electrical apparatus as soon as its efficiency has been demonstrated is being seen once more in the remarkable growth of the electric motor industry. It was the privilege of the writer just a year ago to bring before the National Electric Light Association, in session at Detroit, a few facts and comments on the subject of the use of motors and the electrical transmission of power as it then presented itself. An enumeration was made of the various places at which motors had been introduced and a few figures were quoted as to results obtained. But the material then offering itself, though striking, was notably scarce as compared with that forthcoming to-day, and to those who are in any way familiar with the development going on it is evident that the new work already in hand will, within the next year, dwarf into utter insignificance all that has hitherto been accomplished. Thus it may be mentioned, for instance, that one well-known company shows a total output of over 2,000 small motors: that another concern manufacturing small motors up to about 1 h. p. has built 2,500 since last November; that another company within about the same time—nine months—has sold 1,000 h. p. of motors; that a fourth has, since going into operation, sold about 2,500 h. p., and is now building some 4,000 h. p., and that large factories have been put up for the special manufacture of motors, employing hundreds of men. The importance of this new condition of affairs is hardly yet recognized, but it cannot be denied. It means for one thing that even to-day the electric light station is becoming the great public reservoir of power, and that from its circuits all engaged in manufacture, and thousands who need power for various minor services and functions, can draw supplies at will. In a very short time the consumption of current for electric power will equal, if not excel, the consumption for light, and it is to this new idea that electric light men and the general public are adjusting their methods. There is not an electric light station building to-day in which provision is not being made, in engines and dynamos, for electric power supply; nor is there a manufacturing industry, within city limits anywhere, in which the use of electric motors is not to be tried or has not already begun.

It is, of course, well known that several hundred small motors are in use at the present time deriving current from primary batteries. It is also well known that a large number of motors, averaging about 15 h. p. each, have been applied to street railway work; but it is through the medium of electric lighting circuits that the greatest demand for motors has come and is to be met. In order to ascertain what is being done in this field, THE ELECTRICAL WORLD addressed inquiries recently on the subject to about 500 of the largest local lighting companies. It has been fortunate enough to secure replies from between 200 and 300 of these, and the replies constitute a very interesting presentation of the work done in all sections of the country. A large part of the information furnished has been published during the last week or two in these columns, but it may be well to bring out one or two points that are suggested by the replies as a whole.

It appears that not far short of a hundred local companies are now operating motors, generally, but not always, on their day circuits. A noticeable feature of the replies from companies not doing any motor business is that they "do not run day circuits." This may often be a sufficient reason, but the inquiry is admissible whether sufficient current could not be stored up from the average nightly run of a station with a spare or extra dynamo to feed a day circuit profitably. This is certainly worth trying in some places, and is being done at Cheyenne, where several motors are on storage day circuit. Another point brought out is that the motors are largely on incandescent circuits, the reason for this being obviously that day running is far more a necessity with incandescent stations than with arc stations. Where motors are running upon night circuits they are chiefly employed on newspaper presses.

A question among electric light men has been whether it is best to sell the motor or to rent it out. No unanimity has yet been attained, or is likely to be reached, on that head, although in a great many cases the matter of purchase is left optional with the customer. The sale outright relieves the company of a large initial outlay, but the leasing system seems productive of a much larger income in the long run.

Another question arising is that as to the desirability of selling power at a flat rate or by meter. Many of the companies are charging meter rates, but, on the whole, the flat rate, based on the capacity of the motor, appears to have a decided preference.

It will be remembered that the National Electric Light Association has discussed the propriety of fixing motor rates for its members. Pending that action, a striking variety has manifested itself. A few schedules will show this. The following are the rates at Pittsburgh:

WHERE COMPANY OWNS MOTOR.	Per month.	WHERE SUBSCRIBER OWNS MOTOR.	Per month.
½ horse-power.....	$10.00	½ horse-power.....	$6.00
1 "	15.00	1 "	10.00
1½ "	22.50	1½ "	15.00
2 "	28.00	2 "	20.00
3 "	40.00	3 "	25.00
5 "	60 00	5 "	40.00
8 "	72.00	8 "	55.00
10 "	80.00	10 "	60.00

The company runs its main line to the premises where the motor is to be placed, but all other connections and appliances for the purpose of utilizing the power from that point are made at the cost of the subscriber.

At Buffalo, N. Y., the following rates are quoted:

Size.	Power per month.	Rental of Motor per month.
⅛ H. P.	$ 3.00	$ .50
¼ "	5.00	1.00
½ "	8.00	1.00
1 "	15.00	2.50
2 "	26.00	5.00
4 "	38.50	7.50
6 "	51.00	10.00
8 "	63.50	12.50
10 "	76.00	15.00
12 "		

The above quotations are based on a service daily except Sunday, from 7 A. M. to 6 P. M. Special prices are made where power is required for a different period. A discount of $1.00 per motor is made on bills paid on or before the 10th of month following service. To parties desiring to own their motors the company (Brush) furnishes any size or style. Where motor is furnished by the company, a contract for at least one year's motor use is required.

At Laramie, Wyo., the subjoined schedule has been put in force by the Laramie Electric, Gas Light and Fuel Company.

Horse-power delivered to customers	Rates per horse-power per hour.	Rate for one hour.	Rate per month of 26 days in cases where consumer owns the motor.
40	2½ cents	$1.00	$260.00
20	2½ cents	.50	130.00
15	2½ cents	.37½	97.50
10	3 cents	.30	78.00
7½	3½ cents	.26¼	68 25
5	4 cents	.20	52.00
3	4½ cents	.13½	35.10
2	5 cents	.10	26.00
1	.....	.06	15.00
½	.....	.03	7.50
For sewing machines.	.....	.....	2.00

The Laramie station is about to supply 40 h. p. at $260 per month, as above, to a large flouring mill about 150 feet away.

At Detroit, Mich., the Edison Company is charging $100 per h. p. per year, the patron buying his motor. At Boston, the Boston Electric Light Company, on the same basis of purchase, charges 50 cents per day per h. p. At Des Moines, the rate is $100 per year per h. p. for 10 hours daily with work at constant load; and $100 is also charged at Auburn, N. Y.; Springfield, Mass.; Williamsport, Pa., and Fall River, Mass. At Lawrence, Mass.; Lowell, Mass.; Harrisburg, Pa., and Providence, $125 is charged. At Cleveland, O.; Cincinnati and Baltimore (over ½ h. p.), $10 per month is charged. At Hutchinson, Kan., and Abilene, Kan., respectively, a 5 h. p. motor runs the press for the morning newspaper at $45 per month. At Pawtucket, $100 per year is the rate where the motor is sold and $150 where it is rented. At Rochester, N. Y., where the prime power is water, $50 to $72 per h. p. per year is charged, and at Elgin, Ill., where the day run is made by water power, $60 per year is charged for from 7 A. M. to 6 P. M., and 15 cents per h. p. per hour for night work. At Cleveland 24 ½ h. p. sewing-machine motors are run at $1 each per month. At Galveston, Tex., $15 per month is the rate. At Toledo, O., and Kansas City $2 per month for ½ h. p. is being charged, and at Reading Pa., $1.75 per month. In Boston and New York the rate averages about $100 to $125 per year. Of course, in all cases, larger supply means lower rates.

The work done by the motors now running is endless in its variety, and some of the uses are novel and highly ingenious. A large number of motors have found their way into printing offices, and run the press for such papers as the Lawrence, Mass., *American*; the Detroit, Mich. *Tribune*; the Cincinnati, O., *American Inventor*; the Rochester, N. Y., *Pythian Knight*; the Lowell, Mass., *Daily News*, and the *Daily Courier*; the Elgin, Ill., *News*, and the daily journals at Hutchinson and Abilene, Kan. At Detroit a 15 h. p. motor operates machinery giving employment to 200 people, and it is noteworthy that a motor factory in New York is now putting in one of its own motors to give it power from the nearest electric light station. In fact, it is a common thing to find a motor driving large floors of machinery and keeping scores of men busy, as, for example, in machine shops, shoe factories, clothing stores, printing offices, box factories, book binderies, knitting works, and the like. But the motors can also be found, as these returns show, washing bottles, pumping water from artesian wells at two cents per barrel, brushing down horses, running dental lathes, and driving hundreds of ice cream freezers, coffee mills, ventilating fans, elevators, organs, circular saws, plating apparatus, laundry machines, glove machines and in throwing colors on portraits. At Pittsburgh a 15 h. p. motor is being put in to drive dynamos for the Western Union Telegraph Company, and some are now employed here and there running the generators in telephone exchanges.

It is still early for the establishment of special motor circuits, but there are several now up and more are building in the larger cities. It is to be borne in mind that in New York and Boston a distinct electric power supply (Daft) has existed since 1883, that in New York now distributing over 200 horse-power to about 60 customers, and that in Boston 90 horse-power to about 20. Similar service exists in Worcester and Providence. A special power plant is also enjoyed by San Francisco, and the steps being taken elsewhere in the same direction are too numerous to record.

It remains to be seen whether the power supply will be generally undertaken by special power stations or whether it will chiefly remain in the hands of the lighting stations. In Boston the Edison light station is running 72 motors (Sprague) from ¼ h. p. to 15 h. p., with a total call for 300 h. p. of current, and in New York the Edison wires feed 45 motors of the same make with the same range of capacity, taking in all 250 h. p. The Brush companies in New York, Rochester, Buffalo, Galveston and Philadelphia have a large number of motors of different makes in use, and the Brush Company in Baltimore has about 60 motors (Baxter) on its arc circuits. At Providence the Narragansett Electric Light Company is putting about 30 h. p. of motors (Thomson) on independent circuit.

One interesting development in New York City deserves special note. The Excelsior Steam Power Company, established as a private concern about thirty years ago for steam power distribution, and lately delivering nearly 800 h. p. over an area of four city blocks, went into the electric motor business not long ago, running for the Electric Power Company the Daft service above spoken of. It is now understood that the company has completed arrangements for the generation and supply of 2,000 h. p. electrically, using the same system, and is already busy preparing its plant. This service will be confined to the district on the east side of Broadway, another service being meantime planned for the west side, to go into operation by the beginning of September. The Excelsior Company has been leasing its motors, charging $4 per week for 1 h. p., $6 for 2 h. p. and $3 for every additional h. p. This includes the current, the use of the machine, supervision and any needed repairs.

Some of the comments made are very significant, and in no case does it appear that the motor is at a disadvantage as an instrument of power distribution when compared with other machines. Thus it is remarked by the local company at Appleton, Wis., that water-power is so cheap it would not pay them to run in the day time for electric power supply. Yet it is in Appleton that the electric motor has made a splendid showing on street railway work, the generator being driven by water wheel. As to the size of motors, it may be said that it was at first thought that the bulk of the business would be around 5 h. p., but the demand is as brisk for motors of 10 and 15 h. p. and larger as for those of any other smaller capacity. All told, there are probably over 10,000 electric motors in America to-day, of some fifteen different makes—Brush, Thomson, C. & C., Cleveland, Baxter, Van Depoele, Daft, Edgerton, Sprague, Hawkeye, Bergmann, Griscom, etc. Of one of these motors alone, over 30 types are now being built to fill orders and carry in stock—a point of no small importance as illustrating the remarkable commercial development of this latest electrical application.

Red Bank, N. J., proposes to substitute electric lights for its oil lamps.

Poughkeepsie, N. Y., will use electric motors on its street railways.

Austria.—An electric railway is now being constructed in Graz, on the Schlossberg. Another Austrian road to be worked electrically is that from Hainfeld to Ramsan, for which a concession has already been obtained.

The Coming Motor.—In the course of an interesting article on "The Coming Motor," the Philadelphia *Times* says: "Electricity is now admitted to be a greater and better motor than steam, but it is still an unbroken colt in the field of science. It is still in its swaddling clothes, and scientific research and mechanical genius have much to do before it can be accepted as the motor of the world." It is to be devoutly hoped that the unbroken colt will get out of the swaddling clothes as soon as possible. Some of us think it is out now.

New York City.—Considerable progress has been made with the new Brush station in Elizabeth street, which bids fair to be, when finished, the largest and finest in the world. Mr. McGrath, the energetic and capable superintendent, states that the station will deliver 2,000 h. p. of current. A big portion will be required for motors, of which a large number—C. & C., Brush, Sprague, etc.—are now on the circuits. Mr. McGrath has adopted the rental system for motors. The lighting business continues large and is growing steadily.

The Silvey Dynamo and Motor.

Among the dynamos and motors which have recently made their appearance are those of Mr. W. L. Silvey, of Cincinnati, which present several novelties in construction. The machine for 150 incandescent lights, or 15 arc lights, shown in the illustration, Fig. 2, consists essentially of a cast iron field of circular form, having six wedged-shaped pole pieces, the whole forming a closed ring, inside of which the armature revolves. In the ordinary construction of dynamo machines having ring armatures, the usual practice has been to make the pole pieces nearly encircle the armature; but in the machine which Mr. Silvey has designed, this practice has not been followed, and instead of making the poles nearly encompass the armature they have been made very narrow, so as to inclose each only a very small portion of the armature ring. The spaces between the wedge-shaped poles on the field are wound with coils of wire, and in this way, it is claimed, an increased action is produced by the induction of one side of the coils on the armature, in addition to that of the poles. By a series of experiments, extending over a considerable time, Mr. Silvey has found that the poles on the field do not need a greater area than that of the section through the field magnet core. By this combination of a very narrow pole piece on the field, and by making the field of circular form, so as to bring both poles of each magnet on the field in close proximity to the armature, as well as the coils on the field themselves, the efficiency is said to be greatly increased.

In order to simplify the construction of the machine as much as possible, it has been found advisable to cast a hole in each alternate pole on the field. By this means, after the casting has been finished, wedges can be driven into the holes in the poles on the field, and the casting broken into three pieces. It has also been found to be as easy to wind a circular field magnet as it would be to wind a straight magnet. After the field has been wound, the three parts are bolted together by a spider at each end, which supports the shaft. Experience has also proved that the ragged edges caused by breaking the casting form a perfect joint, and they not only form an excellent magnetic joint, but also act as sutures to keep the casting firmly together.

The armature is composed of laminated iron rings, of No. 36 gauge, bolted together through wedge-shaped poles, which correspond in number to those on the field; that is, a machine with six poles in the field has six poles in the armature, the number of poles on the two always corresponding in number. The distinguishing feature of the armature is the manner of its winding. The depressions between each pole on the ring are wound flush with the pole, and each alternate coil is wound in a different direction, the alternate poles being north and south or *vice versa*. The coupling of the armature is of the class known as multiple for incandescent work, and series for arc lighting. In coupling up for incandescent work the inside ends are all joined together to one terminal and the outside ends to the other terminal. In this way only two ends connect with the commutator, which is on the outside of the bearings and in the most convenient place. The reason for winding each alternate coil in a different direction and joining all inside ends to one terminal, and the outside ends to the other terminal, is that in this way every one of the inside ends of the coils might become grounded on the core without injuring the working of the machine. Whereas, if they were wound differently and the two coils should become grounded on the core, the machine would at once cease to generate a current.

By tracing all these connections, it will be found that the armature is of the open circuit class, so that during one revolution it changes its polarity as many times as there are poles in the field. It was found that these changes, being so sudden and so frequent, were liable to produce sparks at the brushes. This has been overcome in the following way: After the armature has been properly wound with its conductors, there is wound over it three layers of iron wire, each entirely encircling the armature, covering up the coils, and thus coming in direct contact with the poles on the armature. With this addition, simple as it may seem, the output of the machine was increased at least 70 per cent., and the sparking at the brushes was entirely overcome.

From a long series of experiments Mr. Silvey has come to the conclusion that an armature should have no poles whatever, but that all its polarity should be produced by the poles on the field. Briefly stated, the results of his experiments are as follows: 1. The field of a dynamo machine should be of circular form, entirely inclosing the armature. 2. The field should be of the multipolar type, and the part of the pole which projects nearest the armature should be very narrow. 3. The machine should be so arranged as to get the induction of both poles and one side of the coil of the field of the armature. 4. The armature should have as few coils as possible for the sake of simplicity and efficiency. 5. The armature should have no polarity whatever, except that given it by the induction from the field. 6. The armature should be entirely covered with iron wire, so as to equalize the magnetism and bring the inductive influence of the field in the closest proximity to the coils on the armature. In the motor designed by Mr. Silvey, which is illustrated in the engraving, Fig. 1, the armature, which is of the Gramme type, is very large, and consequently for the same power makes a lesser number of revolutions than if the armature were of smaller diameter. The field is, perhaps, the most distinctive feature of the machine. It consists essentially of two very heavy cast iron pole pieces between which the armature revolves. The top parts of these pole pieces are bored out to receive the ends of a A-shaped wrought-iron bar, on which the coils are supported. The wrought iron bar is made of the best Swedish or Norway iron, and bent on a form after the ends have been turned to fit holes in the cast iron pole pieces. The object of bending a bar into this shape is to obviate the use of a heel plate and to inclose nearly the entire wrought iron by the coils. This also obviates all joints in the iron and maintains a uniform section of iron throughout the entire field magnet core. By this arrangement there is practically no loss by leakage at the heel of the magnet.

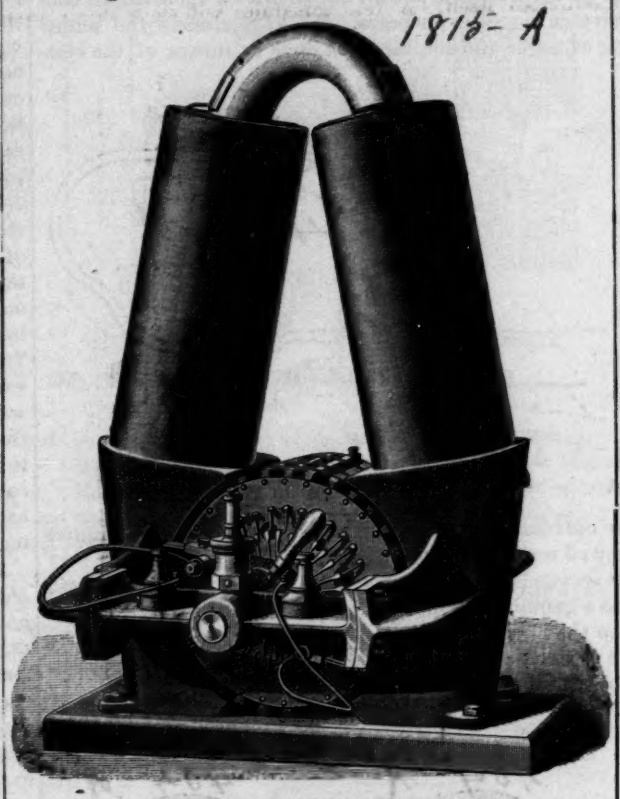


FIG. 1.—THE SILVEY MOTOR.

The coils for the field are wound on an iron spool or bobbin, and after having been entirely completed are slipped on to the core before the ends have been inserted into the cheek pieces. In case of accident to a coil which would render it useless, the same may be slipped off and a perfect one slipped on in its place in a few minutes.

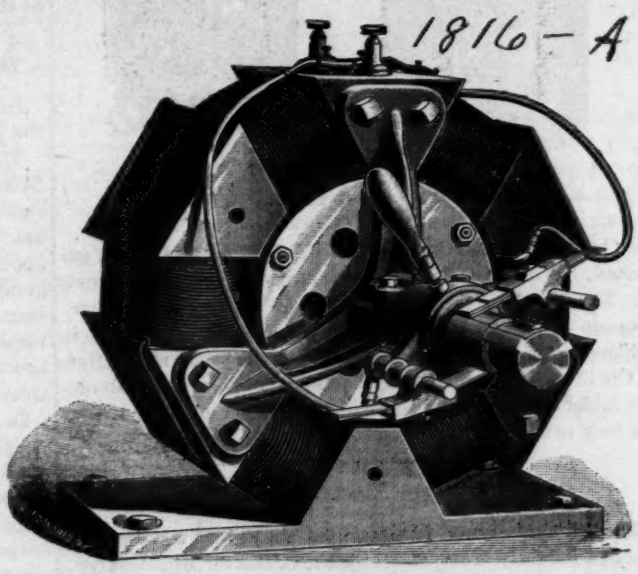


FIG. 2.—THE SILVEY DYNAMO.

It will be observed that the pole pieces of the machine are very heavy, they being made of the best quality of soft cast iron. At either side there are projections or arms cast on them which serve as a support for the bearings. By this means the machine is made self-contained and requires no base plate, so that it can be set out of line.

The armature, while wound on the Gramme style, is constructed so as to have a polar projection between each coil. This is done in order to bring the magnetic effect of the core as near to the poles on the field as possible. The armature is comparatively short, being one-half as long as its greatest diameter, and it is supported at each end by a brass plate or head, thereby making the armature strong and durable. The armature has a speed of 700 revolutions per minute and a diameter of 16 inches.

The machine illustrated is compound-wound and does not show a variation of over 2 per cent. between full load and no load. The motor occupies a floor space of 26 × 30 inches and is 30 inches high. It weighs 900 pounds and develops 12 h. p. with an electrical efficiency of a little over 91 per cent. it is claimed.

The motor shown in the cut was built more especially for street car service, to be placed on the front platform, but is equally well adapted for other work.

A Telephone Siren.

At a recent meeting of the Berlin Electrical Society, Prof. Karsten described his telephone siren. This instrument consists of a disc, to the face of which are fastened radially small steel bar magnets. This disc is revolved by clockwork, and the pole of an ordinary Bell telephone, with diaphragm removed, is presented to the rim of the disc. The rapid passage of magnet poles induces currents in the telephone, and a musical note is produced in a telephone receiver connected with the siren. If all the magnets present the same polarity outwards, the number of complete waves produced during one revolution of the disc equals the number of magnets; if, however, the magnets are placed with alternating polarity, the number of complete waves is half that of the magnets, but the waves are stronger. In this case, the tone heard in the receiver is the lower octave of the tone in the former case. It is also possible to arrange other combinations; for instance, if the poles are placed in the succession *N N S, N N S*, etc., the tone heard is the fifth of the former. Prof. Karsten has found that this combination gives tones most readily distinguished by the human ear, and he recommends it where this apparatus is to be employed for the measurement of resistances by the use of a telephone instead of the galvanometer in bridge tests. He finds that the sound given by the siren is more easily distinguished from accidental noises which often accompany the employment of the usual make and break arrangement. By combining the siren with an anemometer it is possible to tell the strength of the wind from the tone produced in the receiver.

A New Dead Beat Electrometer.

M. J. Carpentier described at a recent meeting of the French Academy of Sciences a new form of absolute electrometer, which has the advantage of being perfectly aperiodic. The movable armature, which carries a pointer, is a metal strip about $\frac{4}{10}$ of an inch wide, bent into a rectangle, and either suspended by a torsion wire in the vertical form or resting upon knife edges in the horizontal form, in which case the electrostatic attraction is balanced by gravity. This movable armature can rotate between the coatings of a cylindrical condenser composed of four quadrants. There are thus four pairs of coatings, diametrically opposite pairs being electrically connected. The novelty of M. Carpentier's design consists in making the coatings of iron, and combining with one pair of them a strong permanent horseshoe magnet, so that the armature swings in a very intense magnetic field. The eddy currents generated in the metal of the armature by its movement through the field tend to retard such movement in very much the same way as the needle of an ordinary mirror galvanometer is damped by being suspended within a thick copper casing. The result is that upon charging this electrometer the pointer moves slowly to its position of equilibrium without swinging backwards and forwards, and the instrument is therefore suitable for very rapid observations.

Sherlock's Tell-Tale Telegraph for Steamships.

According to the London *Electrician* this is an automatic tell-tale, placed in the engine room of ships, and arranged so that should the engineer in charge misread the indication given on the ordinary telegraph dial, or should he move over the reversing link contrary to orders, an electric alarm would be set ringing, and would continue to ring until the mistake was rectified. This is done by means of a contact plate capable of moving in a vertical direction and controlled by the movement of the reversing lever. This plate has a hole in its centre, into which projects an insulated point fixed on a plate whose circular movement is worked from the finger on the dial in the engine room. When an order is signaled by the officer in charge, and is recorded on the dial in the engine room, the contact point is moved round, and if the order is fulfilled the contact plate is necessarily moved in the same direction as the point; but should the reversing lever be moved in the opposite direction, then the plate also moves in the opposite direction, thus closing an electrical circuit through the point and ringing a bell.

Electric Mining Lamps.—At a recent meeting of the Manchester (Eng.) Geological Society attention was called to a portable electric lamp for mining purposes, introduced by the Edison Electric Light Company, and said to have been tried with satisfactory results at the Atherton collieries. The apparatus consisted of an accumulator and an incandescent lamp combined, the whole weighing about 7 pounds. It was stated that the cell would maintain the lamp at 2½ c. p. for about 14 or 15 hours. The size of the apparatus was 7 by 5 by 4 inches. The lamp is arranged in front of an enamelled reflector, and behind a thick plate of glass.

The Jubilee of the Telegraph in England.

Special Cable Dispatch, Mackay-Bennett Cable.

London, July 27, 1887.—The jubilee of the electric telegragh in England was celebrated by a great meeting of electricians in London last night, a banquet being given at the Holborn restaurant. It was one of the largest gatherings of British electricians ever known. The postmaster general, the Rt. Hon. Cecil Raikes, M. P., was in the chair. At the tables reserved for distinguished guests were Sir William Thomson, F. R. S.; Sir Lyon Playfair, M. P., F. R. S.; Mr. John Pender, Mr. G. Shaw Lefevre, M. P.; Sir Frederick Bramwell, F. R. S.; Sir David Salomons; Sir George Elliot, Mr. Matthew Gray, Sir James Anderson, Mr. H. Weaver, Mr. William Crookes, F. R. S., and others well known in the scientific world. At the head of the seven tables were Mr. H. C. Fischer, Controller of the Central Telegraph Office, London; Professor D. E. Hughes, F. R. S.; Mr. W. H. Preece, F. R. S.; Sir Charles Bright, Major-General Webber, Mr. C. E. Spagnoletti and Mr. Latimer Clark. Dr. Alexander Muirhead was also present. Telegrams and letters of regret and congratulations were read by Mr. Preece from Dr. V. Stephan, Berlin; Dr. Werner Siemens, Berlin; Mr. Cracknell, Sydney, N. S. W.; Mr. C. Todd, Adelaide, S. A.; Mr. George G. Ward, General Manager Commercial Cable Co., New York; Sir Albert Chappell; Dr. C. Lemon, Wellington, New Zealand; Mr. Kingsford, Lima. The chairman, in proposing the health of the Queen, remarked that it was a happy coincidence that the jubilee of the best of sovereigns and the jubilee of one of the greatest blessings to mankind were coeval. After the National Anthem had been sung, the chairman asked the company to drink in silence to the memory of those great men who had gone to their rest before the completion of the jubilee they were then celebrating. He then proceeded to eulogize those two great pioneers of the telegraph, Cooke and Wheatstone, and showed a piece of the original wooden bed in which the five wires of the old five-needle circuit were laid. He also exhibited a short length of the first submarine cable which was laid between Dover and Calais in 1853; and he referred in flattering terms to Mr. Crompton, who had a share in the great work and who was also present that evening. Another speaker was Mr. Edwin Clark, one of the veterans of the telegraphic world, who gave an interesting account of his connection with Cooke and Wheatstone, and the difficulties encountered by the pioneers of the telegraph. Mr. John Pender spoke of the present development of telegraphs; he said his mission was more to speak of submarine telegraphy. He reminded the gathering that he was not an electrician, but a commercial man who had helped to lead science by the hand to glorious results. There was a prophecy that a girdle would be put around the world in forty minutes, but now we could send a message around the world in twenty minutes.

Mr. Pender concluded a most effective speech by saying that when the history of Queen Victoria comes to be written it would be found that telegraphy had done more to bind together the mother country with the colonies in various parts of the world than political or any other influence.

Sir William Thomson came next and was received with tremendous cheering. The great physicist and electrician said that he was more associated with submarine than inland telegraphy. He referred to the pioneers Steinheil, Gauss, Weber and Ampère, and paid a high compliment to the illustrious Morse, who, in America, almost simultaneously with Englishmen, laid the foundation of telegraphy. Sir William Thomson also evoked a hearty burst of applause when he eulogized the grand work of Cyrus Field, by whose exertions England and America were first joined together by the electric wire. He mentioned also in feeling terms the late Cromwell Varley and regretted the absence of his friend, Willoughby Smith. The success of the 1865 cable he held was almost wholly due to the exertions of Cyrus Field and John Pender.

Sir Lyon Playfair, who responded to the toast of the scientific societies, said that in a conversation he had had with the late Sir Charles Wheatstone, that eminent electrician denied that he was the inventor of the telegraph and declared that Oersted and Faraday were the real inventors of telegraphy. In conclusion, Sir Lyon Playfair said that the lesson telegraphy teaches us is that science is the mother of inventions. When some one asked Faraday what was the use of abstract science, the illustrious scientist answered, "What is the use of a baby?" Sir Lyon reminded the distinguished company present that it was the work of the learned societies to nurse science, which contains the potentialities of the marvelous inventions that tend to revolutionize and improve the world.

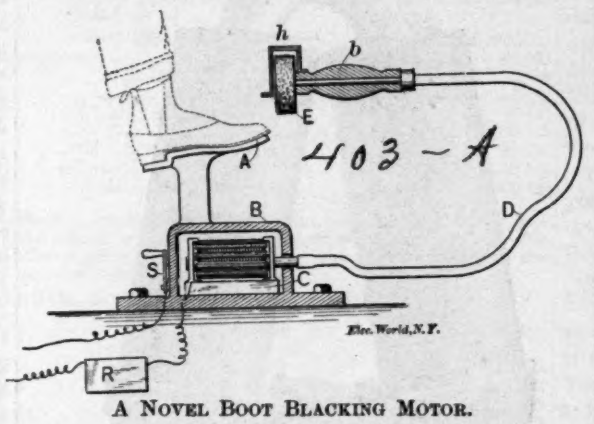
The following is the special dispatch, above alluded to, sent by Mr. G. G. Ward and read at the banquet:

W. H. Preece, London: The British electricians in the United States, with American friends and associates, send hearty congratulations and greetings to company assembled to celebrate this day the memory and work of Cooke and Wheatstone, and the jubilee of the telegraph. All rejoice in an anniversary which finds New York as near to London as Camden Town was to Euston Square fifty years ago, and which sees the great name of Wheatstone honored the world over in connection with inventions that have become the nerves of commerce, that have made nations neighbors, that have broken down prejudice, and promoted knowledge, friendship and peace in the whole universe. God bless old England.

Signed, Geo. G. Ward, for the committee.

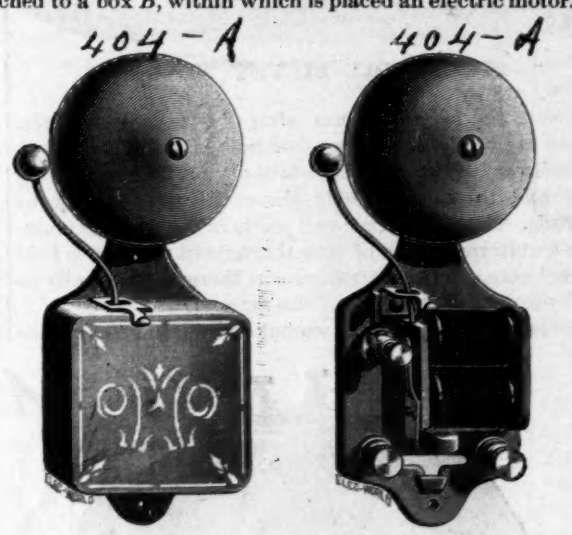
Electric Boot Blacking Apparatus

As not far short of 500 towns and cities in this country are supplied with central electric light stations distributing electricity in private houses, there is no reason why the power available should not be drawn upon for all conceivable domestic purposes. We have already the pump ing of water and similar work done by means of the electric current; cooking is also accomplished, as our columns showed some time since; and now there is no reason why the servile labor of boot blacking should not be converted into a genuine pleasure. Such evidently seems to have been the idea of Mr. Henry R. Gardner, of Boston, who has recently patented the electric boot blacking apparatus shown in the accompanying illustration.



A Novel Boot Blacking Motor.

As will be seen, the apparatus consists of a foot-rest *A* attached to a box *B*, within which is placed an electric motor.



Figs. 1 and 2.—A Novel Bell.

To the spindle of the armature a flexible shaft *D* is attached, the other end of which carries a revolving brush *E*. The speed of the machine can be regulated by the resistance *R*, and by means of the switch *S* the machine is stopped entirely. In order to prevent the rapid revolution of the brush from throwing particles of blacking about, the latter is covered by a shield, except at the point where the hair is applied to the shoe.

A Novel Electric Bell.

The accompanying illustrations show a new vibrating call bell recently brought out by Mr. C. Baxter, of Brooklyn. The bell has been specially designed with the object of preventing the entrance of dust, and, at the same time, of

Fig. 3.—A Novel Bell.

affording easy examination. For this purpose the inclosing case, it will be seen, is provided with a tongue which fits into a recess in the frame of the bell. The cover, when placed on the frame, has the tongue first inserted in this recess, and then by pressing it forward it is passed under the lip of the spring above the magnets, which holds it securely in place.

It will also be noticed that the frame of the bell has a slot in line with the binding posts. Thus in cases where the wires are laid inside a wall they can be brought out, connected to the binding posts and completely hidden from sight by the cover. Where this is not the case, the wires can be brought to the binding posts through the two notches in the lower edge of the cover.

Another improvement introduced consists in providing a binding screw for the adjustable contact point, by means of which the adjustment is not affected by jarring. The bell is neatly made throughout and the contacts are tipped with platinum.

A Curious Electric Motor.

Mr. W. F. Fay and H. S. Pullman, of Rockville, Conn., have been exhibiting in Hartford a curious piece of mechanism. The apparatus consists of a magnet and an iron wheel, provided with 18 projections from the rim. On the shaft of the wheel is a fan which dips constantly in a trough of water and serves to equalize the motion and probably to assist it at certain points in the revolution by the impetus of the current established as the wheel revolves. On the shaft is also a rachet of nine teeth, which, bearing on a lever, causes an oscillatory motion in a plate of metal coated with some composition which lies between the poles of the magnet and the wheel. The whole apparatus is mounted on a block of wood. The magnet is placed tangentially to the wheel, and it is entirely conceivable that in the proper position it should cause a motion of the wheel through a small space. As a matter of fact the wheel revolves steadily. The explanation of the inventor is that he has discovered a composition (that on the bar in front of the poles) which cuts off the attraction of the magnet toward the wheel when interposed. The rachet interposes it just at the point when the wheel would naturally come to rest; the wheel moves on a little with its momentum and a new projection comes within the attractive power of the magnet, causing further motion, and so on and so on. As close an examination as could be made disclosed no opportunity for concealed batteries, clockwork or any other outside device for causing the motion of the wheel.

Assuming, for the sake of argument, says the Boston *Herald*, that it is moved precisely as described, it is still not a perpetual motion according to the old conception of something which makes force from nothing—a thing contrary to the fundamental laws of mechanics. If, however, a magnet be considered as a piece of iron, which, through its condition, is always passing a current of electricity, due to the earth itself, and manifesting its presence by the phenomena of attraction and repulsion that are familiar to every one, then it is conceivable that a continuous force might be supplied in the manner described, provided some means of cutting off the attraction has been discovered, as is claimed by Mr. Pullman.

It would, doubtless, be more satisfactory to see the apparatus mounted on a bed-plate and columns of clear glass, so that there could be no room for suspicion of any device hidden by opaque material. But as it stands, it is exceedingly interesting. The wheel revolves at the rate of about 25 turns a minute, and with a power that is very appreciable when one checks it by putting a finger on one of the fan blades or on the edge of the wheel.

The Electric Motor and the Small Steam Engine.

In the course of an excellent article on cheap engines in the *American Machinist*, Mr. W. H. Hoffman says:

The electric motor is being rapidly introduced for powers from 1 to 20 horses, and in displacing the so-called cheap steam engine of these capacities the builders of the electric machines have demonstrated that they could sell power at about the standard price of steam in the large cities. They generate their current with the most improved automatic steam engines, using from 2.75 to 3 pounds of coal per horse-power per hour, and allowing for all losses, they can produce a horse-power cheaper than the cheap engine, besides doing away with the services of an attendant.

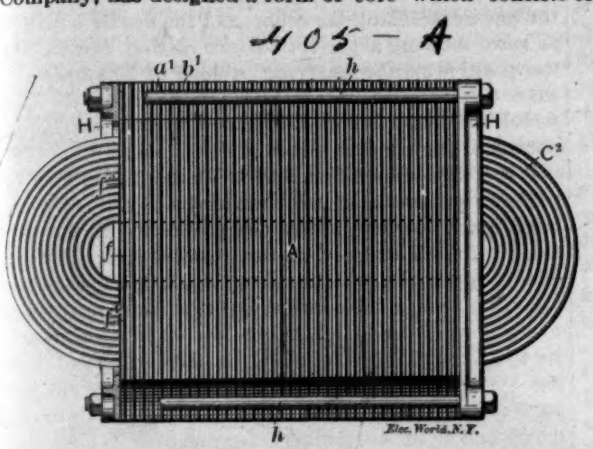
In testing some of these cheap steam engines the electric people found that these engines were actually using 60 pounds of water per horse-power per hour, so that they were not obliged to use much effort to beat these conditions. Every steam engineer must admit that the discoveries of our electrical brethren in the small engine service are rather discreditable to us, when the commercial value of the two machines are considered. I say discreditable, because the electro-motor builders find no trouble in selling a 20 horse-power motor for $1,300, or at the rate of $65 per horse-power, while we get but $20 to $23 for our very best automatic steam engines. The electric engineers, then, have demonstrated that a machine costing more than three times as much as another one, to do the same work, can be sold, because its commercial duty is very much above the cheap machine. I speak of the electric machinery to illustrate the truth of my argument only, and not to carry the idea that the economical steam engine of 20 horse-power is to be displaced by the electric apparatus at present, for the average electric motor in use to-day ranges from 5 to 15 horse-power.

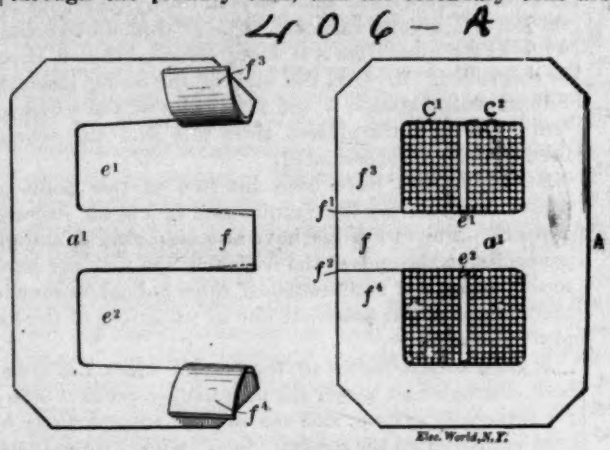
The facts stated above must lead us to the firm conclusion that the small cheap steam engine must be built better, whether it be cheaper to the builder or not. The economic producing power is what the customer is after, and he is finding out, at last, that a steam engine built mostly in the foundry is not the kind of an engine best suited to his wants. He has learned by experience that a saving in his fuel consumption of over 40 per cent. means something, and therefore we find that the first-class small automatic high speed engines usually sell readily, even at an advance of from 50 to 75 per cent. in price over the cheap engine, comparing diameter of cylinders.

The Westinghouse Converters and Overhead System.

It is well known that, in order to avoid heating and consequent waste in electric converters, the iron employed in them must be ample in section and well laminated. It has also been found that the best results are obtained when the coils are entirely surrounded by iron.

In order to make the construction of such coils convenient, Mr. Albert Schmid, of the Westinghouse Electric Company, has designed a form of core which consists of





FIGS. 1, 3 AND 4.—DETAILS OF WESTINGHOUSE CONVERTER.

thin plates, each in one piece, which completely surround the coils.

The converter, as it appears with the outer casing removed, is shown in Figs. 1 and 2, and the manner in which it built up is shown in Figs. 3 and 4 As will be seen, the primary and secondary coils C^1 and C^2 are surrounded by an iron core A, which is composed of thin iron sheets or plates a^1, alternate ones of which are magnetically separated from each other by thin sheets b^1 of paper pasted to the plates of iron.

In preparing the plates a^1, rectangular sheets are stamped with two holes e^1 e^2, which are themselves rectangular in form, and of such size as to receive the primary and secondary coils. Each opening e^1 and e^2 is cut open, as shown at f^1 and f^2, respectively, the cuts being in a line with the inner edges of the corresponding openings. It is not always be found necessary to have the cuts exactly in line with these edges; but one or both of them may be in a diagonal direction, as indicated by the dotted lines in Fig. 3. This has the advantage of sharpening the tongue f and making it more easy to insert it in the coils.

The central tongue f extends through the interior of the coils. The separate plates are then applied by springing the portions f^3 and f^4 backward, in the manner shown in Fig. 3, then thrusting the tongue f through the coils and allowing the plate to return to its normal position, Fig. 4. The iron used is so thin that the operation may be very readily performed by hand without the use of machinery.

For the purpose of breaking joints, the alternate plates a^1 are inserted from opposite sides, so that the slits f^1 f^2 of one plate are against the solid portions of the two adjacent plates. The plates are so placed that the bare metallic surfaces of two plates rest against each other, and the opposite insulated surfaces of these plates rest against corresponding insulated surfaces of their contiguous plates.

In building the converter, the plates are temporarily pressed together by clamps. The plates, when as many as practicable have been inserted, are tightly pressed against each other, and to accomplish this, two end plates, H and H, are placed at the ends of the converter and bound against the same by four bolts, h, h, h, and h. The plates H and H are of cast iron, surrounding the projecting ends of the coils and resting against the edges of the end plates a^1. To render the completed converter as compact as possible, the corners of the plates are cut off to allow room for the bolts.

In running the circuits for distributing the current by means of converters, the method pursued in a number of instances consists in extending the primary conductors along one set of cross-arms of a line of poles, the upper arms, and the secondary conductors along the lower arms. The converters are mounted upon the poles at convenient distances, the primary coils being connected in circuit with the primary conductors, while the secondary coils have their terminals connected with the secondary conductors. The feeders are led from the secondary conductors at the desired points, and the converters are inserted wherever required for maintaining a constant difference of potential throughout the secondary circuit.

The accompanying illustration, Fig. 5, shows the manner in which the circuits are run. The poles P^1 P^2, etc., are each provided with two cross-arms, a^1 a^2. The primary circuit L^1 L^2 extends along the line of poles, carried by the upper arms, a' a'. The secondary conductors are in like manner supported from the lower cross-arms a^2. At convenient points feeders l^1 l^1 and l^2 l^2 are led off to supply the lamps d^1 d^1 d^2 d^2. Heretofore it has been customary to lead the secondary conductors directly to the points where the currents are to be used; but by this method the secondary circuit is parallel with a greater or less portion of the primary circuit, and the service wires are derived therefrom as required.

It is necessary that the difference of potential between the secondary conductors be maintained approximately constant throughout the length of the circuit. The converters C^1 C^2 are therefore interposed between the primary and secondary conductors at the required intervals for securing this result. They are fastened to the posts or cross-arms, and the primary conductors are connected through the primary coils, and the secondary coils are connected with the secondary conductors upon the lower cross-arms. This system has been devised by Messrs. H. M. Byllesby and O. B. Shallenberger, of the Westinghouse Electric Company, and is employed in a number of their installations.

Use of the Magnetic Needle in Exploring for Iron Ore.*

BY BENNETT H. BROUGH.

As a general rule, geological and mineralogical methods alone are used in exploring for ore deposits; only in a few exceptional cases are physical methods possible. Thus, in

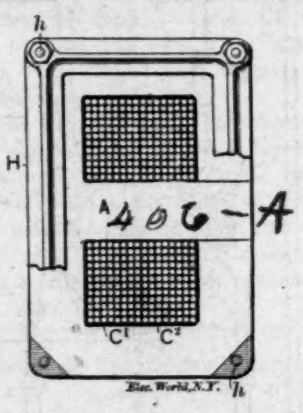


FIG. 2.—DETAILS OF CONVERTER.

exploring for magnetic iron ores the compass may afford valuable aid, and has, in fact, been employed for this purpose in Sweden and in the United States for many years. The theory of its use is based upon the fact that certain minerals deposited in the earth become magnetic by induction under the influence of the earth's magnetism, and that, consequently, the two poles are fixed in the direction of the magnetic meridian, or, more exactly, in the direction of the magnetic inclination at the opposite ends of the deposit. It is well known that there are substances, such as steel and magnetite, exhibiting polar magnetism; that is to say, they retain the magnetism once acquired even if the inducing force ceases to act. Other substances, such as soft iron and magnetic pyrites, exhibit simple magnetism; in other words, they are magnetic only so long as the induction remains. The intensity of the magnetism exhibited by deposits of magnetite varies greatly, and is frequently so slight that only delicate instruments and practiced observers can detect it; in other cases the needle is affected at considerable distances. It must, of course, be remembered that a given magnetic force affects the needle to exactly the same degree through 100 feet of granite as through the same distance of air. If the magnetic north pole of the earth is regarded as negative, and the south pole as positive (in the northern hemisphere) the upper end of a vertical mass of ore will be negative and the lower end positive. Consequently, if a magnetic needle is brought near the upper or negative pole of the deposit, the north-seeking or positive end of the needle will be attracted. When the point of observation is very near the ore-pole, the needle will dip downwards. The lower or positive pole of the ore-mass, being usually situated at a considerable depth, will not affect the observation. Other deposits, coursing in a more or less easterly and westerly direction, are less affected by induction; the poles being situated in the long sides of the deposit. Frequently the deposits are faulted and broken. In this case the separate portions behave like fragments of a broken bar magnet, the adjacent ends exhibiting opposite polarity. In exploring for ore, then, if, on advancing from north to south, the free needle is first attracted and then repelled, a fault in the deposit is indicated. To explore for ore the ordinary miner's dial or surveyor's circumferenter may be employed. If a straight line is followed with the instrument, the needle will remain directed towards the same point of the dial; or, in other words, will remain in the magnetic meridian as long as it is kept sufficiently far away from iron and magnetic ore masses. But if these are approached the needle will gradually be deflected. The only case in which there will be no deflection is when the attracting deposit is approached along the meridian passing over its upper pole. It follows that in magnetic surveys the meridian line must first be found and fixed in the field or on the plan. For this purpose at least two straight lines are set out in the magnetic east and west direction, from thirty to fifty yards apart. These lines will at some point cross the meridian line. If the dial is set up at one end of a line of this kind, at a considerable distance from the magnetic mass, there will, of course, be no attraction. On approaching the meridian, the needle will be gradually attracted, and at a certain distance the maximum attraction will be reached. On approaching nearer it will become smaller, until, at the ore meridian itself, it will be inappreciable. The angles of deflection observed at the various stations are noted on pegs driven into the ground, and also in the field book, or on the plan. Following the same straight line to the other side of the zero point—or, what is the same thing, to the other side of the ore meridian—the same attractions are exhibited, but in reversed order; the needle turning back to the meridian. If similar observations are made along the second east and west line it is easy to fix the ore meridian by joining the two points where there is no deflection. These points are midway between the two points of maximum deflection. This passes over the upper pole of the deposit, and if the pole is approached along the meridian line the dip of the north-seeking end of the needle will, as a rule, be greater the nearer it comes to the pole. This method is, however, not adapted for fixing the position of the pole exactly. This may be done by determining the isogonic lines—that is to say, by joining the points where the needle has the same deflection.

In order to obtain one or more parallel isogonic lines on both sides of the ore meridian, it is necessary to set out a number of lines parallel to the ore meridian, and from ten to thirty yards apart. At the points where these lines intersect the east and west lines, the angles of deflection must be observed, and isogonic lines constructed by joining the points of equal deflection. The needle being drawn so much out of its horizontal position that its free play is

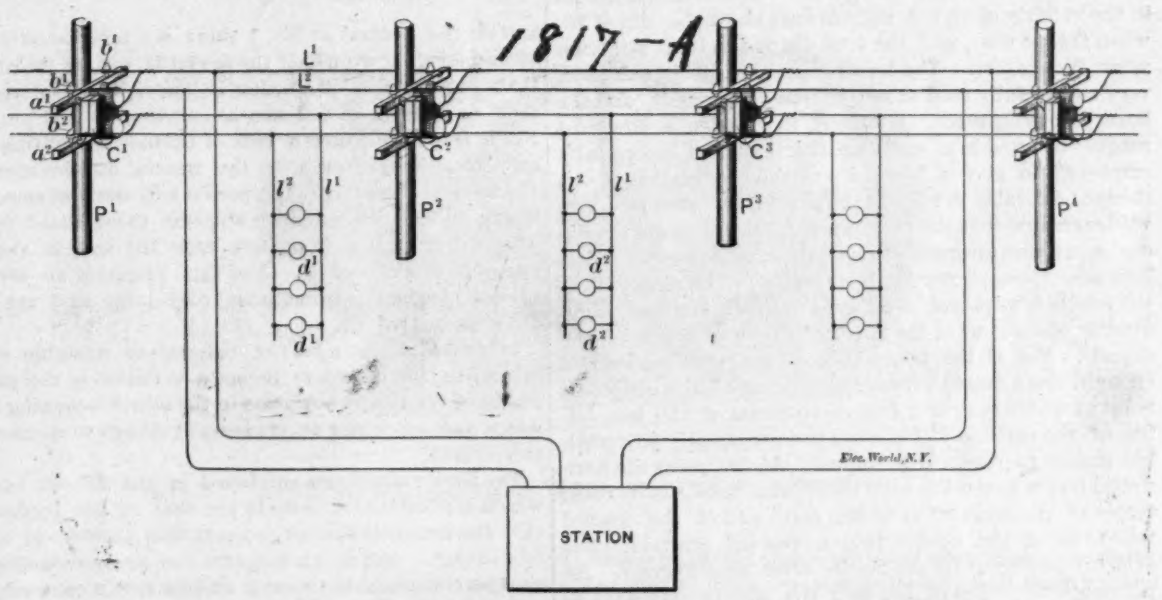


FIG. 5.—WESTINGHOUSE ALTERNATING CIRCUIT SYSTEM.

* Before Iron and Steel Institute in London.

hindered, it must be weighted and balanced by a piece of wax. If, now, from some point of intersection in the network of squares made on the field of observation, a line is drawn in the direction of the deflection of the magnetic needle, it will cut the isogonic curve at a second point, and, eventually, the ore meridian. The two points where the isogonic line is cut are joined; the joining line is bisected, and at the point of bisection a perpendicular is erected; then, perpendicularly under the point where this cuts the meridian, is the upper ore pole, and at this point it will eventually be found best to sink the shaft, so as to be certain of cutting the ore mass. The ore meridian, it must be noted, need not always be a straight line. In cases where a better instrument was not available, excellent results have in this way been obtained with the ordinary pocket box-compass, held in the hand.

For preliminary magnetic surveys no instrument is better than the Swedish compass. In this instrument, the needle, besides revolving in a horizontal plane in the usual manner, can also turn in a vertical plane to an angle of about 60° with the horizon. The needle is horizontally suspended in a brass case on a long vertical brass pin by means of a long glass cap. The brass terminates above in a short steel point, on which the glass cap rotates. At the bottom of this is a brass stirrup, provided with fine holes, through which pass the horizontal pins supporting the needle. To enable the needle to dip there is a long slot cut along the middle of it. The compass-box can be suspended by means of three strings passing through three small rings fastened 120° apart on the outside of the box. It can thus be easily carried in hand. Graduation is not usual, and, indeed, unnecessary. Only the cardinal points are marked, as in using it deviations from the horizontal position alone have to be noticed. This compass was invented in the last century by the celebrated Swedish miner, Daniel Tilas, and is still in general use. The dip of the needle is estimated merely by the eye, and is not actually measured. The miner's, or dip compass was invented in the United States in 1866, and was adopted by the Geological Survey of New Jersey in the systematic explorations for magnetic iron ore in that State. In this instrument the magnetic needle is suspended so as to move readily into vertical direction, the angle of inclination being measured upon the divided rim of a small compass-box. The needle cannot move horizontally. When in use the ring is held in the hand, and the compass-box, by its own weight, takes a vertical position. It must, of course, be held in the plane of the magnetic meridian, which can be determined by holding the instrument horizontally. In this way it serves as an ordinary pocket compass

With the dip compass, whether Swedish or American, perfectly trustworthy results can only be obtained when the observer is acquainted by long experience with the peculiarities of his instrument. Compass explorations being in many cases the sole source of income, it can easily be understood that a skillful operator will be inclined to keep his mode of procedure secret. Consequently the uninitiated are apt to believe that the operator must be specially gifted; and frequently the supernatural properties formerly ascribed to the divining rod are transferred to the compass. This excess of faith in some is accompanied by skepticism in others. For this, unfortunately, there are good grounds, the compass being so admirably adapted for dishonest purposes. Thus, Mr. T. B. Brooks mentions an American prospector whose compass needle in the vicinity of an ore mass always showed a dip of 90° when facing west, and the true dip due to local attaction when facing east. The former position, it is said, was very successfully used in selling iron-ore grounds, and the latter in buying them. Similarly in Sweden a powerful magnet inserted in a walking-stick has been successfully employed to give a large dip to the needle when it was thought desirable to mislead the purchaser. As a rule, surveyors assume that the most ore must occur where the dip compass shows the greatest inclination, or is perpendicular. This assumption, however, is erroneous. The place where the needle is attracted most by a vertical ore bed is not directly above, but to the north of, the south pole of the deposit. For, if the magnetism of the earth is powerful enough, there must be somewhere north of the ore pole a point at which the horizontal components of the magnetism of the earth and of the ore bed are equally powerful, but acting in opposite directions. At this point the horizontal forces neutralize each other, and then the vertical forces of the magnetism of the earth and of the ore bed tend to bring the needle into a vertical position. The evidences afforded by the needle often lead to error. An unimportant pocket of ore near the surface may have as great an action on the instrument as a larger ore mass situated far below the surface. It is thus seen that in exploring for iron ore with the magnetic needle, purely scientific method is necessary. The compass should be employed for preliminary work, in order to save time and labor; but before a shaft is sunk recourse should be had to a more accurate method.

Electric Light for Picnics.—The Cumberland Valley Railroad Company has adopted a new portable electric light for use at picnics, fairs and other celebrations along the line of its road. It was used with great success at the recent Gettysburg encampment.

Hammer's Balance Indicator and Feeder Ampere Meter.

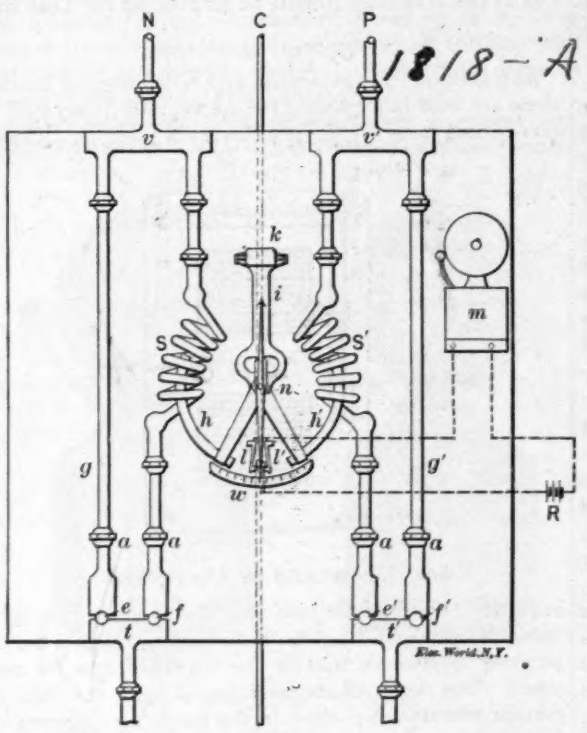
When the various dynamos in an Edison three-wire central station are connected to the omnibus wires in the station, each machine as it supplies its current to either side of the system possesses a certain individuality as a dynamo, and as soon as these currents are united or mixed up in the "buss" wires, this individuality is lost.

The feeders connect directly the omnibus wires, and at this point the current gains a new individuality, which is of greater importance than it is in the dynamo; for it is subject to a greater variation, is more difficult to control, while at the same time it is more essential that it should be controlled. In fact, the end of the feeder inside the Edison central station is the vital point of the whole system. But up to the present time this fact has scarcely been sufficiently appreciated.

Safety catches have been inserted at this point as a means of protecting the circuits and to cut off excessive currents. Pressure wires have also been used in stations, connected to the ends of the feeders where they are joined to the network of mains outside, these indicators showing the rise and fall in potential due to variations of the load in these feeders.

A main ampère meter on the "buss" wires has always been employed on either the negative or positive side of the three-wire system, and the neutral ampère meter has been employed on the neutral "buss" wire. By multiplying the reading of the positive or negative ampère meter by 2, and substracting or adding the readings of the neutral ampère meter, according as the needle indicates ampères to the right or left of the zero point, the amount of current passing out of the station is determined. This neutral ampère meter, however, may be quite misleading in its indications.

Let us suppose, for instance, that we have three feeders



Hammer's Balance Indicator and Ampere Meter.

and on the neutral of No. 1 there is a positive current of 50 ampères, showing that the feeder is out of balance to that extent. No. 2 feeder indicates a negative current or a lack of balance amounting to 100 ampères. No. 3 feeder indicates a lack of balance amounting to 50 ampères. Nevertheless, on the neutral ampère meter on the neutral "buss" wire the needle will stand at zero, indicating an absolute balance; whereas these three feeders were out of balance in the one case 100 and in the two others 50 ampères each. And this variation in the balance of feeders is sometimes very large and varies at different hours.

It is evident that a lack of balance or unstable equilibrium, in these feeders means a variation in the candle-power of the lamps, variation in the bills, blackening of the lamps and especially causes lamp breakage to a considerable extent.

The feeder equalizers employed in the Edison system, which are inserted directly in the line of the feeder and vary the potential thereof, correct this trouble to a certain extent. And it is a fact that the pressure indicators are to a considerable extent a satisfactory means of indicating this variation; indeed, an admirable one. But up to the present time no satisfactory means have been employed to properly indicate the variation in load on the two sides of the three-wire system, either in the feeders individually or in a system as a whole.

It was to overcome the difficulties above mentioned, and at the same time to afford other facilities, that Mr. Wm. J. Hammer, manager of the Boston Edison station, designed the balance indicator and feeder ampère meter, illustrated in the accompanying diagram.

The apparatus fulfills several objects. It is in the first place an absolute instrument inserted directly in the end of each feeder where it is joined on the omnibus wires in the station. As the current leaves the "buss" wires *N*, *P*, and gains the individuality spoken of above, it passes through the indicator, which consists of two solenoids *S*, *S'*, inserted in the positive and negative sides of the feeder.

The action of the solenoid, as is well known, is dependent upon the number of turns, the ampères circulating in them, and to a certain extent upon the mass of metal in the soft iron core. It will, therefore, be readily seen that if the amount of current flowing through the positive and negative wires is exactly the same, the inductive pull exerted upon the two soft iron cores *h h'* will be the same, the one neutralizing the other; and the needle *n* will stand at zero, showing a perfect balance on that feeder. Should the positive side be carrying a load of 50 ampères more than the negative, the needle will indicate the amount which the feeder is out of balance by the position of the pointer to the right or left of the zero point.

It is a well-known fact that while the feeder may be in perfect equilibrium at one hour of the day, it may, at the next hour, be very much out of balance on the positive side; and an hour later, on the negative side. By means of this apparatus, which is always in circuit in each feeder, the variations in the condition of the feeder may be noted every hour of the 24. If this is known it is a simple matter to place new customers on the lighter loaded side of the system. In certain specific cases, where the lack of balance is considerable, it may even be advisable to change over some of the customers from one side of the system to the other.

It can readily be seen that where an indication of this kind is being made at all times on each individual feeder, these corrections can be effected very easily in a short time and the entire system brought to a perfect balance. It is also apparent that where a system is well balanced, not only does it mean a great saving in the breakage of lamps, due to the rise and fall in potential, and a great saving of complaints from parties that their lights are not sufficiently bright at certain hours, and lessening complaints that the lamps are blackening, but there is a very manifest advantage in the facility with which the apparatus and the station as a whole can be handled.

It seems probable that in many stations where the system is balanced by means of such an indicator as here proposed, it will not be essential to employ an artificial resistance to vary the potential as is now done, with feeder equalizers as a means of regulating the two sides of the system; or at most it may be necessary only on certain feeders where the variation is excessive at different hours.

In many stations there are feeders which, instead of having a maximum loss or 10 per cent., have double this or more at certain times. In other cases there are feeders which have a surplus of 50 per cent., or more, of copper. These conditions are seldom appreciated, as there are no means at hand to determine them.

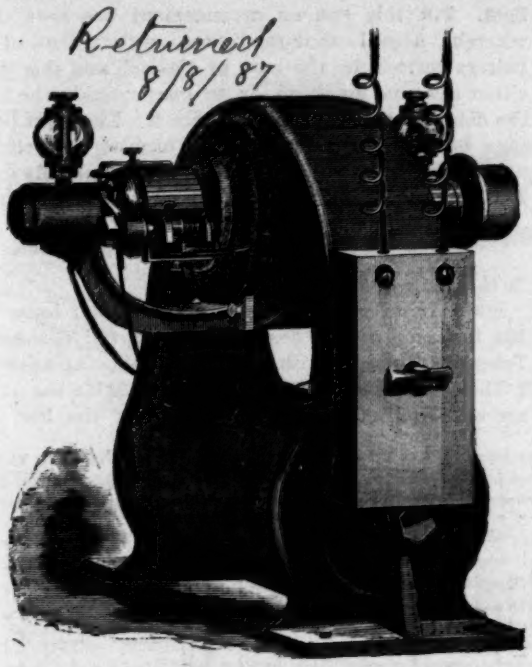
By means of this indicator and feeder ampère meter, the amount of current flowing through each feeder can be directly shown by inserting a plug at *f'* on the opposite side of the feeder, and withdrawing a plug from *e'* on the same side. The current is then shunted around the solenoid *S'* on the same side. The instrument then becomes a simple ampère meter and the needle indicates in actual ampères the amount of current that is flowing through the feeder on the negative side. By replacing the plug *e'* and withdrawing the plug *f'* and making a similar change of plugs on the negative side of the feeder, the negative solenoid *S* is cut out of circuit and the positive thrown in, indicating the amount of current circulating on the positive side of the feed. The sum total represents the amount of current the feeder is carrying, which can be measured at any time. It will be understood that when the two solenoids are acting in unison, the amount of current circulating in the neutral wire *C* will be indicated by the pointer on the scale *w*, this being the difference between the inductive pull of the two solenoids.

It has been shown wherein this instrument indicates the electric balance on each feeder, and how it indicates the amount of electricity which each feeder is carrying. We might add that, knowing this, we can, by connecting up the feeders by new bridges, or by changing the proportions of the conductors, get the maximum benefit from the investment in copper, which, besides saving the interest on the investment in copper, effects a saving in coal by cutting down the excessive loss of current in the system.

There is, however, still another application for this instrument. In the accompanying diagram is shown an electric bell *m*, which may be operated by a battery or by current from the feeder itself. This bell, which is preferably an electro-mechanical gong, has a connection with all the feeders, the connection being made through the medium of small contact springs shown at *l* and *l'*. As already stated, at the end of the feeder where it joins the "buss" wire, a safety catch is inserted. This safety catch is composed of an alloy of lead and tin, and melts at a temperature of about 400 degrees. In the event of a short-circuit or overload on this feeder, before the temperature of the copper could be raised to a dangerous degree this alloy has reached its melting point and the fusible strip is volatilized and the circuit opened. In the event of a cutting out of a feeder in this way, the lights supplied by that feeder are not put out, as the system of mains outside are joined together in a net-work, and these lamps are supplied by current from some other feeders. These feeders may at that time, however, be slightly overloaded, so that such an additional load might cause their safety catches to

give way; and not infrequently have stations been entirely shut down by this means, and in some cases the whole of one side of the system put out. Below the connection shown is inserted a multiple form of safety catch.

In the event of a short-circuit or overload, causing the melting of a safety catch, one of the solenoids loses its energy, and the one on the opposite side tends to suck in the iron core to the fullest extent; and, when this is done, the contact springs at *l* and *l'* are pressed together and the circuit completed through the electric bell. The attendant in the station, hearing at any time this gong ring, knows that a safety catch has melted, and that the connection on one of his feeders has broken. As he looks at the dials on his indicators, he notes that one of them is way off the scale, and he instantly goes to that one and inserts a plug in the multiple safety catch, thus throwing in a fusible strip of greater capacity, and re-establishes the



THE CLEVELAND MOTOR.

circuit. This, of course, may be done automatically by various means, but it suffices to say, that, whereas at the present time the fusible strip inserted in these conductors is to some extent an element of danger, it is, by means of this apparatus, made a means of absolute safety.

The province which this instrument fills in indicating the balance, and the measurement of the amount of electricity, and in protecting the continuity of the circuits at the most vital point of the central station system, shows that it has the merit of originality and is destined to fill an important place in the establishment of future electric lighting plants.

A Smart Inspector.—A gas inspector in San Francisco has been refusing to approve some city electric light bills there because the company did not use large enough carbons to suit his taste, his idea being that the larger the carbons the more light they would give! He has been disabused of this impression, and the bills have been paid. Mr. G. H. Roe made a scathing presentation of the matter before the street lights committee.

The Earth as an Electric Light Station.—Some of our greatest inventions are now coming from the West. A special dispatch from Canyonville, Ore., says: "The Honorable James F. Glazley, an attorney resident here, has invented a static machine which will revolutionize completely the present methods of electrical lighting. By an ingenious contrivance he gets brilliant electric jets from the earth."

Transportation by Pneumatic Tube.—A little book has been published recently by Cassell & Co., called the "Republic of the Future," by Anna Bowman Dodd, in which great use is made of electrical applications as features of civilization in the year 2050. The book comprises the letters of a Swedish nobleman who arrives in New York in that year from his native country, by means of the Pneumatic Tube Electric Company's line, which he had taken in preference to the balloon, as he wished to view the submarine scenery.

Twice in the Same Place.—Talk about lightning striking and never striking twice in the same place—we know of a case where it struck in two places some distance apart at the same time. Some years ago a local company of this city that laid great stress upon having its risks well detached insured an ice house on the West bank of the Mississippi River, above the city of St. Louis, and another on the east bank of the Mississippi River, well down in East St. Louis. Lightning from the same cloud set fire to them both, and both were burned.—*Cincinnati Price Current.*

"So Great a Competitor."—Mr. George H. Christian, Jr., of Norwalk, in a paper read before the annual meeting of the Ohio Gas Light Association, commented on the tendency to lower the price of gas, as follows: "From a financial point of view, we will find it absolutely requisite to practice the closest economy, for we have no more the lighting field to ourselves. Electricity, on the one hand, and oil on the other, are struggling for a share of our business. So great a competitor, in fact, has electricity become, that we are advised by many leading men in the gas business to absorb it, and become the dispensers of both gas and electricity; but to absorb means to buy up all opposition plants. Our only security lies in our ability to furnish electric light in conjunction with gas for less than the electric companies do it themselves; then, and not till then, can we certainly control that business."

The "Cleve'and" Electric Motor.

Our illustration represents the 3 h. p. motor built by the Cleveland Electric Motor Company, of Cleveland, O., and shows the general style of a variety of sizes and types now built by that company. A noticeable feature of the motor will be seen to consist in the fact that only one coil of wire is employed on the field magnets, while the armature is supported above between the extended pole-pieces. The core upon which the coil is wound is of soft charcoal hammered iron, and the two pole-pieces are cast from the same pattern, with extensions at the bottom which form the feet of the machine. Every part is planed, turned and bored to exact measurement, jigs or templates being used, so that the motors of the same size are interchangeable. Besides the cap screws, of which there are six, taper pins are so placed that the whole comes exactly together even before the screws are entered.

While for the same power the motors to be used on different circuits have the same frames, the windings are, of course, different in each case. Thus a 1 h. p. frame has five different spools and five different armatures, each representing a type, such as a 6½ ampère, a 9½ ampère current, or a 110 volt circuit. Each of these spools or armatures exactly fits the frame, and it is possible to change the motor to run on the three different circuits in from ten to fifteen minutes. Electrically the armatures are, as a rule, of the plain Gramme type, although armatures for some purposes are built on the Siemens plan.

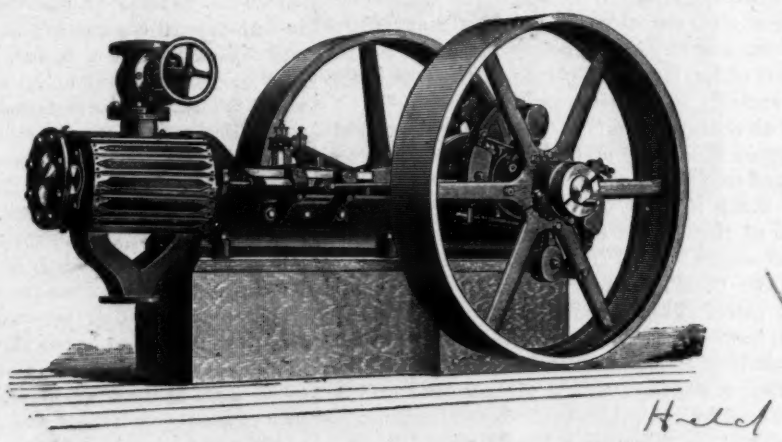
Throughout all these changes the electrical balance between amount of iron and amount of copper on armature and field is so computed that no undue heating nor any sparking takes place. As for regulation, the constant potential machines, being shunt wound, are automatic, and hence self-regulating.

The starting and stopping is easily accomplished by so winding and proportioning the fields that in starting the first move of the switch converts the motor into a compound wound machine, and the final movement converts it into a plain shunt machine. To stop the machine it is only necessary to turn the switch quickly back to its original position. This simple and effective method does away with all rheostats.

The arc current motors are in the main plain series wound, and are regulated by either a hand switch or by the governor, as suits the requirements. Their running and regulation is claimed to be equal to that of the constant potential motors. We may add that the company has already placed a large number of these motors in operation, and is now estimating on several electric railways.

Improved Fitchburg Engine for Electric Lighting.

Our readers will be interested in the improved style of high speed engine which we illustrate to-day, and built by the Fitchburg Steam Engine Company, of Fitchburg, Mass. It has a style of bed which has become a favorite one because of its strength and stiffness and gracefulness of outline, usually called the "Porter bed." The governor is the same in construction as is used upon their well known independent valve automatic horizontal engines,



FITCHBURG ENGINE FOR ELECTRIC LIGHTING.

and is absolute in its control of the engine under the most abrupt variations of load or steam pressure. Unlike some of this class of governor it has very small frictional surfaces; hence there is no resistance to change of relative position of the moving parts when the load upon the engine changes.

The eccentric does not touch the shaft at all, nor does it encircle and move upon another which itself turns upon the shaft, each giving a large frictional surface and, if allowed in any way, to get dry an unsteady control of the engine.

The Fitchburg Steam Engine Company have for 16 years used the balanced piston valve and in over 1,000 engines, claiming for it, when rightly made, superiority over any other style of valve. Running horizontally, gravity leads to downward wear, and unless this can be in some way remedied it soon becomes disastrous, they say, in allowing leak and great waste of steam and fuel.

The Fitchburg Company, from the first, in using piston valves, have made them so that they are readily adjustable in diameter, so that an hour's time, once in eight to fifteen months, will adjust for all wear without any expense or trouble. By this means the valves can always be kept tight, instead of waiting until they are very leaky before replacing.

The crank shaft, as will be noted, has counterbalanced plate cranks, and is built with some peculiarly excellent features. The whole workmanship and material employed are of the best, special tools and gauges being used, and all parts being interchangeable. While electric lighting absorbs a good part of the first-class high speed engines built, these engines are well adapted to almost all classes of work of whatever nature.

Theatre Lighting in Paris.

We have already drawn attention to the action brought about by the burning of the Paris Opéra Comique, by which all Paris theatres, cafés, etc., are required to have the electric light installed within a short period. The municipal committee who were instructed to investigate the whole question have made their report, and their opinion is expressed in the most emphatic terms. They say: "To avoid fires we must suppress their cause, namely gas. Gas should be entirely prohibited under any form whatever. Install electricity. It is not for us to appear as the patrons of any one particular industry, but the results which have attended the introduction of the electric light are absolutely conclusive in this matter. We recommend, therefore, that the Council should pronounce in favor of electricity for the lighting of theatres, but without specifying any particular system; and we would add that the motive power should be placed outside the theatre, if only for the excellent reason that in the majority of theatres it is impossible to make proper provision for the plant inside the walls." The committee recommend the appointment of a special commission to consider in detail the measures of precaution to be taken for each of the municipal theatres and for the unsubsidized places of amusement. The attitude of the fire insurance companies in this matter has long been an index of the relative safety of gas and electricity, and their judgment in reducing the rates of insurance where electricity is employed is once more confirmed.

Atmospheric Electricity.

R. Nohrwold, from a long series of experiments, as quoted by Prof. M. B. Snyder, in the *Journal of the Franklin Institute*, draws some interesting conclusions as to the possibility of electrifying air. By coating a suitable glass receiver on the inside with glycerine, and then filling it with smoke, he is able to show to a considerable audience that one or two turns of a Töpler machine discharged from a point within the receiver is sufficient to clear the air by projecting the smoke upon the glycerine. Following up the question of statically electrifying pure air by a great variety of tests, he concludes that he has shown more thoroughly than has been done heretofore, that electricity streaming out from points, cannot statically electrify the air itself, but rather the suspended dust consisting of solid or liquid bodies. Glowing platinum wire was found to render pure air capable of being electrified, on account of the slow evaporation or emission of small particles, and it was shown that on these particles, and not in the air, the charge resided. He concludes that it is very probable that atmospheric air and other gases probably conduct themselves similarly—cannot be statically electrified. He also gives a new experiment, according to which, at ordinary temperatures, negative electricity of high potential more readily escapes from solid conductors into atmospheric air, than positive electricity.

Might be Tried in New York.—One of our enterprising stockmen, wishing to make a wire fence, and not wishing to go to the expense of buying redwood posts, used green willow posts instead, to which he attached the wire. The trees, like all things planted in Pillarcitos soil, soon began to grow, and very naturally the wire grew up too. Now the ranchman is devising means et his wires down from mid-air.—*San Mateo Gazette.*

The Robbins Automatic Ground for Telegraph Circuits.

Probably four-fifths of the operators on railways in this country have other than telegraph duties to perform, such as those of ticket agent, freight clerk, book-keeper or station agent at some small yet important telegraph station. All these functions tend to distract the operator's attention from the telegraph unless he is called or desires to use the circuit himself.

It was with the object of removing these difficulties that Mr. A. C. Robbins, electrician of the Robbins Electric Signal and Telephone Association, of this city, designed the telegraph circuit shown in the accompanying illustration. The improvement made by Mr. Robbins consists in employing a constantly flowing normal current and increasing the same when it is desired to make a signal. This latter is accomplished by shunting the resistance *W*.

His principal object, however, in addition to this, is to prevent the disabling of the line which would ordinarily be caused by a break or ground, and this is accomplished by employing an automatic ground by which the circuit is automatically completed at the last accessible station when a break occurs. By the placing of a galvanometer on the circuit the position of the break or ground can be very closely located.

While adapted to a large variety of electric circuits this system is specially applicable to railway telegraph service.

In the illustration the circuit is shown as applied to such a system, in which *H H'* are terminal stations, and 1, 2 and 3 are way stations. The transmitting apparatus is not shown at the terminal stations, but is the same as illustrated at the way stations.

If the line were not broken at *X* a current of normal strength would flow from the battery *B*, through relay *E*, galvanometer *J* and rheostat *R* to line *L*, to station 1, through the magnet *M*, *O*, the fixed resistance *W*, receiving instrument *S*, magnet *m*, and similarly through stations 2 and 3 and *H* to earth through battery *B*. This current is of sufficient strength to magnetize the electro-magnets *M*, *m* at all the stations, and hold the armatures *A*, *a* away from the adjustable points attached to the ground plates *G G*, but it is insufficient to attract the armatures of the receiving instruments and cause a signal.

When a break occurs, as at *X*, a temporary demagnetization of magnets *M m* takes place, and the armatures are all retracted and make connection with the ground points *G G*. When this is effected, a divided circuit is set up at *D*, *d*, one part of the current passing through *D*, *A*, the ground contact and resistance C^1 to earth; and the other part through *M*, *O*, *W*, *S* and *P* to *d*, where the same division takes place. That part of the current passing through *M* is, however, sufficient to attract the armature *A*, thereby removing the ground connection, after which all of the current passes to *d*, which division and ground is likewise removed by the magnet *m* becoming sufficiently energized to attract the armature *a*.

Thus, one by one, the ground circuits are all removed, except those of the armatures a^2 and a^3 at stations 2 and 3. There being no circuit through their respective electro-magnets on account of the break at *X* they are forced to remain at the earth connection, completing a circuit each way from the break until the same has been repaired. The resistances C^1, C^2 and C^3 in the ground circuits are somewhat higher than the resistance of the electro-magnets *M*, *m*. They serve as compensators when these magnets are cut out by the break and more nearly equalize the current to earth and to line when a division takes place at *D d*. They are made separate for each ground in order to prevent short-circuiting between *A a* when both are on the ground contact.

In order to maintain the normal condition of the circuit from *B* to a^2, the operator at *H* compensates by means of the rheostat *R* for the resistance usually offered by the stations 3 and H^1. As this resistance is approximately known to him before hand, he is at once aware of the number of stations missing from his circuit. The attendant on duty at H^1 likewise compensates for *H*, 1 and 2, and is thus informed of the extent of his circuit. All transmitting keys on the circuit are normally left open. The key at station 3 is shown closed, shunting the fixed resistance *W* and causing a signal by the corresponding increase of current, as is indicated by the relays at 3 and H^1, and the increased deflection on the galvanometer J^1.

Assuming that there is a trunk line between *H*, H^1, as shown by the dotted line *T*, the same could be attached as shown, with the battery ground connections removed, thus making intermediate batteries of *B* and B^1, and forming a complete circuit from earth through C^3, to earth through C^2, and permitting of full communication between the terminal stations. By means of this system the failure of operators to close their keys, or to place the line to earth, in order that they may be communicated with when interruption occurs, causes no interruption of communication, so that train dispatchers and other railway officials can always command the movement of trains.

The system is equally applicable to police, district messenger and similar systems, so that a break or ground causes no interruption to the service.

Forbes' Ampere Meter.

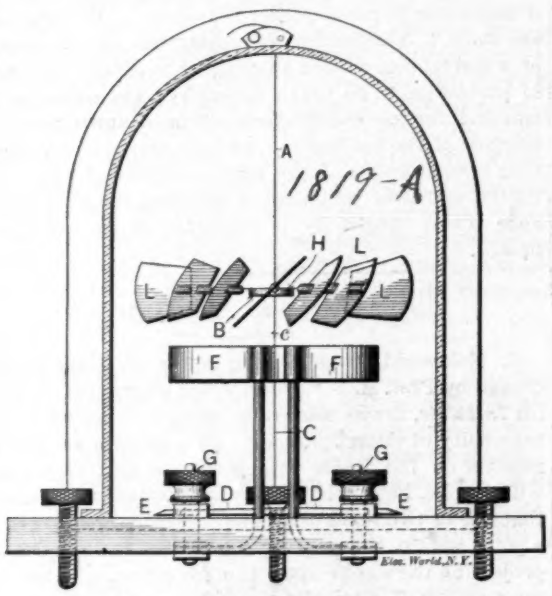
Heretofore the strength of a current as indicated by its heating effects has been measured by the calorimeter, but in an apparatus devised by Prof. G. Forbes, and recently patented in this country, the heating effect of a current is employed to create a mechanical power for the indication of the current. In the apparatus of Prof. Forbes, a conductor is heated by a current of electricity, and this heat is carried away by the air in contact with the conductor. The velocity of these air currents is proportional to the strength of the current in the conductor. Hence, by introducing an apparatus to measure the velocity of the air currents, the strength of the electric current can be determined.

In order to make an instrument of this nature delicate in its action, it is necessary to reduce all frictional fluid resistances, by allowing a free circulation of the air. For this purpose the radiating conductor is raised an inch above the base of the instrument, and the latter is also inclosed in a case to guard against external currents.

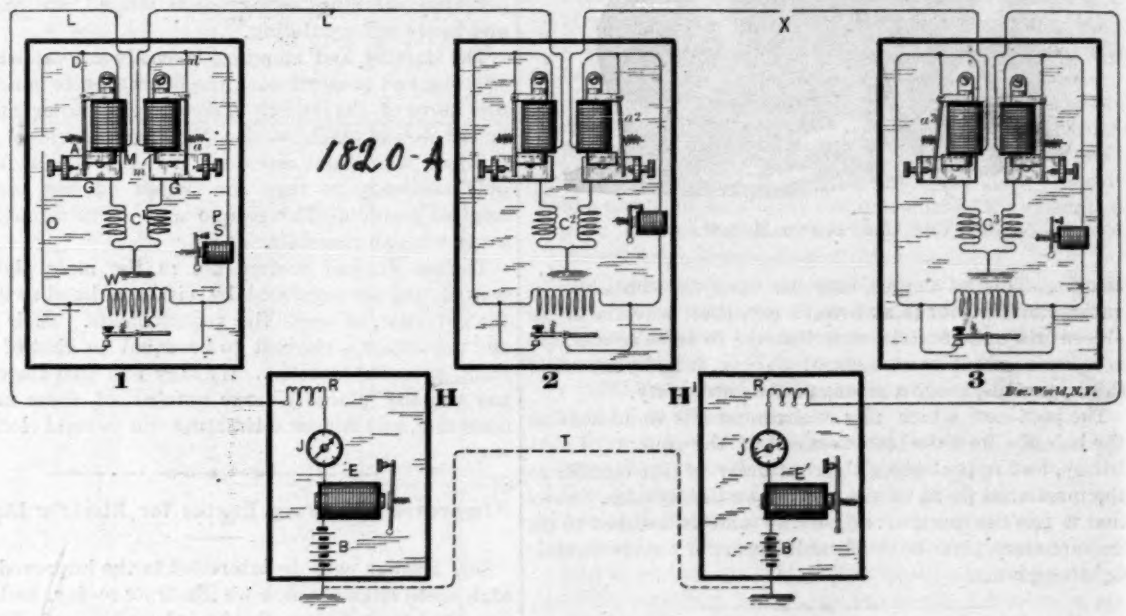
One of the forms of apparatus devised by Prof. Forbes is shown in the accompanying illustration. It consists of a circular disc of mica *H*, about two inches in diameter. Ten corks are fixed by cuts in the corks on the periphery of the mica circle. Mica vanes *L L* inclined at an angle of 45 degrees to the mica circle are fixed one to each cork. The whole is suspended at its center by a fine wire of silver *A*, and from the center hangs down a wire *C* and horizontal pointer *D* which points to divisions on a circular scale *E E* on the base of the instrument. The electric conductor consists of a circular strip of metal *F*, being slit at one place so as to leave two ends, which are attached to binding screws *G*, *G*, which form the terminals of the apparatus. The circular strip is supported at its two ends and at its middle. It is placed close below the vanes and some distance above the base board of the apparatus, so as to allow free circulation of the air.

An inclosing cylinder is not required for directing the air currents when the apparatus is used; but a glass shade covers the whole apparatus. The divided circle may be divided so that the pointer will indicate the current directly, or it may be divided into one hundred parts, so that a deflection of more than one revolution may be noted, a table of values being in this case provided for converting the readings into the values of the electric current. When it is required to measure very small currents the conductor has a high resistance, and is made of wire wound in many turns.

In order to convert this instrument into a coulomb meter, Prof. Forbes suspends the vane, so that it is free to revolve, and connects with it a train of wheel-work, which registers the number of revolutions made by the vane. In this case, however, the errors due to air friction and to that of the wheel gearing have to be allowed for.



FORBES' AMPERE METER.



ROBBINS' AUTOMATIC GROUND SYSTEM.

Electricity Applied to Line Fishing.

The true sportsman will certainly scout the idea that electricity can possibly lay claim to any legitimate share in the placid delights of the disciples of rod and line. It may possibly, however, be necessary to remind him that fly-fishing is not the only method of pursuing the business. Float fishing, although undeniably the very laziest kind of "sport" under the sun, is still followed, and such being the case there can be little doubt that its devotees will welcome any development which still further diminishes the necessity for any exertion in the pursuit of their ignoble art. The only room for improvement in this direction appears to lie in the possibility of rendering it unnecessary for the fisherman to keep his eye upon the float. For this end an arrangement has been devised whereby a pull upon the line closes the circuit of a tiny battery carried in the base of the rod, and this is made either to sound an alarm or to gently tickle the hand of the fisherman as he grasps the butt. The sport has thus been brought to a state of the highest perfection, for nothing now hinders him from going comfortably to sleep. The London *Electrician* is authority for the above.

Partial Resistance of Telegraph Lines.

To the Editor of The Electrical World:

SIR: In reference to the question in your issue of the 23d inst., under the heading of "Partial Resistance of Telegraph Lines," I wish to give the following answer:

There are given two circuits, *A* and *B*, in the multiple arc with each other. *A* is the part of the line of 150 miles, with 406,824 ohms insulation resistance. *B* is the other part of 30 miles, with insulation resistance unknown. *A* + *B* is the whole line of 180 miles, with 283.734 ohms insulation resistance.

By employing $283{,}734 \times 406{,}824$ volts a current of $\frac{283.734 \times 406.824}{406{,}824}$, = 283,734 ampères will pass through *A*. Hence a current of $\frac{283.734 \times 406{,}824}{283{,}734}$, = 406,824 ampères will pass through *A* + *B*, and a current of 406,824 — 283,734 ampères must pass through *B* alone

Thus the resistance of $B\left(i.\,e.,\ \frac{E}{C}\right) = \frac{283{,}734 \times 406.824}{406.824 - 283{,}734}$ = 856,526 ohms. The formula is $\frac{A \times (A + B)}{(A + B) - A}$.

The above answer is given in calculation of the measurement being taken where the two parts are joined.

BOSTON, Mass. F. A. WESSEL.

Partial Resistance of Telegraph Lines.

To the Editor of The Electrical World:

SIR: In response to the querry of "J." in your issue of July 23, I would offer the following solution of the partial insulation resistance of a telegraph line. From the figures given, the insulation of the whole line of 180 miles is 283,734 ohms, which gives an average insulation resistance of $283{,}734 \times 180 = 51{,}072{,}120$ ohms per mile. Now 150 miles of this line has an insulation resistance of 406,824 ohms, or $406{,}824 \times 150 = 61{,}023{,}600$ ohms per mile. The difference between the average of the whole line, 51 megohms, and 61 megohms for the 150 miles, shows that the remaining 30 miles must have a much lower insulation resistance per mile.

These quantities being known, to obtain the actual insulation resistance of the 30 miles, a simple method suffices to obtain its value in terms of miles of the known line. Thus, the whole line has an insulation resistance of 283,734 ohms, and 150 miles of it has an insulation resistance of 61,023,600 ohms per mile. Then $\frac{61{,}023{,}600}{283{,}734} = 215$ miles is the equivalent length of a line having an insula-

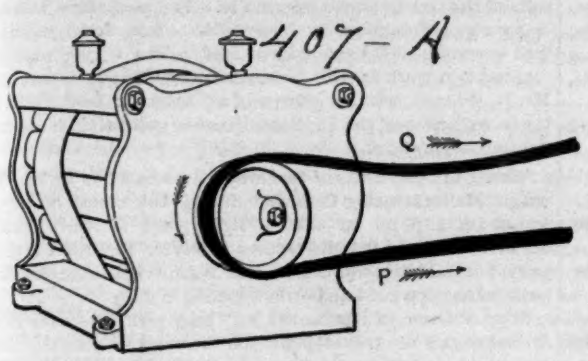
tion resistance of 61,023,600 ohms per mile. Or in other words, 215 — 150 = 65 miles of the larger portion of the line offers an insulation resistance equal to the 30 miles the insulation resistance of which was to be found, and which is therefore $\frac{61,023,600}{65}$ = 908,055 ohms; and its insulation per mile 908,055 × 30 = 27,241,650 ohms.

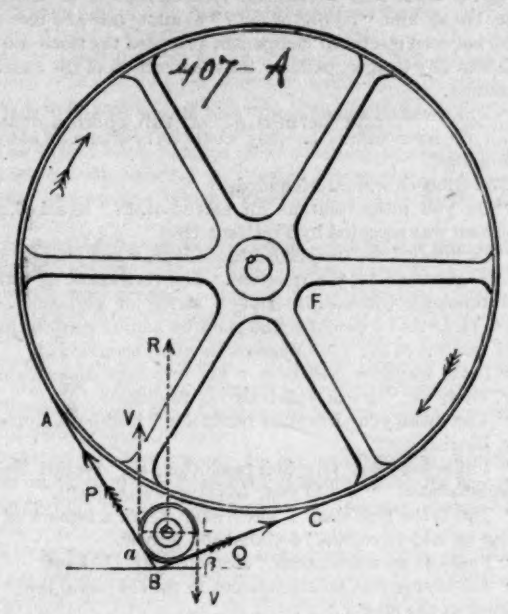
NEW YORK CITY. C. W. TRAFFORD.

The Driving of Dynamos with Very Short Belts.*

BY PROFS. W. E. AYRTON AND JOHN PERRY.

When fast-speed machines, such as dynamos, are driven in the usual way by belting, there is a certain waste of power in overcoming the friction that is set up between the driven spindle and its bearings by the tensions necessary to be given to the two sides of the belt to produce the reqired grip on the small driven pulley. This waste of





FIGS. 1 AND 3.—METHOD OF DYNAMO DRIVING WITH SHORT BELTS.

power is usually kept small by using a long belt and putting the dynamo at a considerable distance from the large driving pulley, and thus obtaining a large angle of contact of the belt with the small driven pulley. But such an arrangement is very inconvenient to employ on board ship or in the guard's van of a railway train or elsewhere, when the space is confined, and a short belt would always be employed were it not that the small angle of contact of the belt with the driven pulley that would be produced if the small pulley was put close to the large driving one, would necessitate the tension on the belt being large. And this large tension would cause considerable pressure on the bearings, leading to a considerable waste of power in overcoming friction; further, the belt would be much stretched, requiring constant adjustment of the dynamo to tighten it to avoid slip. And further, the occasional stretching of the belt produced by atmospheric changes would make the belt slip were the tension when the belt shortens again not far greater than is necessary for driving purposes. Hence the average tension of such a belt must be made to far exceed what a simple calculation of the necessary driving tensions would give, and the waste of power is in consequence also much in excess. Indeed, this is the reason why belting is usually placed more or less horizontal, and why long belts are employed with the upper side the slack side so as to introduce a weight compensation, as shown in Fig. 1. Similar difficulties occur when an electric motor, or other fast speed motor, is used to drive machinery by means of belting.

After describing the various attempts that have been made in the past to remedy this difficulty, the authors describe their new method, which consists in hanging the dynamo pulley L from a short belt passing round the engine fly-wheel F, as seen in Fig. 2, the floor in front being removed so as to show clearly the cradle supporting the dynamo. The belt is only just long enough to embrace the fly-wheel and dynamo pulley without the two being brought into contact. The dynamo D, as in the previous case, is supported so as to turn round an axis at right angles to the axis of rotation of the armature, and the method of fixing the dynamo is as follows: The pulley is removed from the spindle S, and the dynamo is fixed in a cradle C C, turning on trunnions T T, in such a position that the dynamo and cradle just balance. Then if p_1, p_2, Fig. 3, be the pressure of the armature spindle on the two bearings, B_1, B_1, respectively, nearer to and further from the pulley end of the dynamo, $p_1 + p_2$ = weight of armature, commutator and spindle.

The pulley, which is heavier than an ordinary dynamo pulley, but like an ordinary pulley, simply made of cast iron, is now keyed on to the armature spindle and hung in the belt, as seen in the figure, and as the entire weight of the pulley is supported by the belt, the dynamo by itself still balances, and the pressures on the bearings are simply p_1 and p_2, as before. The pulley is made of such a weight, and the cradle carrying the dynamo is placed in such a position relatively to the fly-wheel, that the resultant R of the tensions P, Q, in the two sides of the belt A B, B C, when the dynamo is receiving the maximum driving power, is equal to the weight of the pulley, and acts vertically through its centre, together with the necessary driving couple V V, as seen in Fig. 3. The horizontal components of the tensions in the two sides of the belt are in equilibrium by themselves, so that the pressures exerted by the spindle of the armature on its bearings are simply equal to the weight of the armature, commutator and spindle—that is, are even less when the dynamo is receiving the maximum driving power than in the case of an ordinary dynamo when the armature is *at rest*, since this form of belt gearing, unlike any ordinary belt, communicates *simply a pure couple* to the armature, instead of a couple together with a smaller or greater thrust of the spindle against the bearings.

And not only with this mode of driving need no extra pressure be thrown on to the bearings, but the pressure that is produced merely by the weight of the armature can be diminished. In fact, the pressure on the bearing B_1 nearer to the driving pulley can be made actually equal to naught by slightly altering the adjustments in the following way:

Instead of fixing the dynamo in the cradle so that it balances when the driving pulley is removed, fix the dynamo a little nearer to the fly-wheel, so that the pulley end of the dynamo is a little heavier, and move the cradle a corresponding distance away from the fly-wheel so that the pulley, when keyed on the armature spindle, and the fly-wheel are properly in line. Then the tensions in the two sides of the belt are balanced, not merely by the weight of the pulley, but by this weight plus any portion or the whole of p_1, depending upon the exact position in which the dynamo has been fixed on the cradle. Hence the weight of the pulley may be made smaller by an amount equal to the portion of the pressure p_1 which is carried by the belt and the pressure on the bearing B_1 nearer the pulley, which, with an ordinary dynamo, is by far the larger, can, with this arrangement, be made as small as desired, or even naught, whether the armature be at rest or the dynamo be producing its maximum power. The pressure on the other bearing B_2 will, of course, never exceed p_2, which is usually equal to about half the weight of the armature, commutator and spindle, and since the diameter of the spindle on the side farther away from the pulley can be made comparatively small, as power is not transmitted through it, the power spent in overcoming friction at this bearing B_1 will be trifling. Hence the total waste of power at the bearing can be made practically naught by employing this form of belt gearing.

It is also clear that any slight stretching of the belt will not cause it to become slack, since the only effect will be to lower the pulley slightly, and incline the axis of the armature to the horizontal.

To further illustrate this method of belt gearing, we give the actual calculations made for determining the proper weight to give to the dynamo pulley, and the proper position in which to place the dynamo, which is now being driven by a short belt at the Central Institution.

The four things to be determined are:

1. Proper size of dynamo pulley.
2. Proper weight of dynamo pulley.
3. Proper distance to place axis of armature below axis of fly-wheel.
4. Proper distance to place axis of armature to one side of axis of fly-wheel.

1. The dynamo in question requires about 6 h. p. when running at 1,600 revolutions per minute, and when giving out the safe maximum number of watts. The fly-wheel of the engine is 4 feet 11 inches in diameter, and runs at 180 revolutions per minute; therefore, in order that the dynamo may be driven by a belt directly from the fly-wheel, the diameter of the dynamo pulley must be

$$\frac{180}{1600} \times 4'\,11'', \text{ or } 6\tfrac{1}{2} \text{ inches.}$$

2. Let P and Q be the tensions, in pounds, of the belt on the tight and slack sides respectively, when the dynamo is receiving 6 horse-power, then

$$(P - Q) \times 1600 \times \pi \times \frac{53}{8 \times 12} = 6 \times 33000,$$

$$\text{or } P - Q = 71{,}8, \text{ say } 72, \text{ lbs.}$$

If the rim of the dynamo pulley were in actual contact with the rim of the fly-wheel, it is easy to show that the angle between the belt on the two sides of the pulley would be 105°. The pulley and fly-wheel must not touch, since they would be moving in opposite directions at the place of contact; but, in order to make the arrangement compact, it is desirable that the pulley should be as near the fly-wheel as it conveniently can be without touching, therefore let us take 100° as the angle that the belt shall make on the two sides of the pulley. Then, since the belt makes a tangent with the pulley, the arc of contact of the belt with the rim of the pulley must be 180° — 100°, that is, 80°, or $\frac{4}{9}\pi$. Therefore, if P be the tension of the tight side of the belt, and Q that of the slack side,

$$\frac{P}{Q} = \varepsilon^{0.4 \times \frac{4}{9}\pi}$$

$$\therefore P = (P - Q)\,\frac{\varepsilon^{0.1778\,\pi}}{\varepsilon^{0.1778\pi} - 1},$$

and, as just shown, $P - Q$ = 72 lbs.
Therefore, P = 169 lbs.
and Q = 97 lbs.

By the triangle of forces it is seen that the resultant of P and Q equals 180 lbs. Therefore if the dynamo is so placed

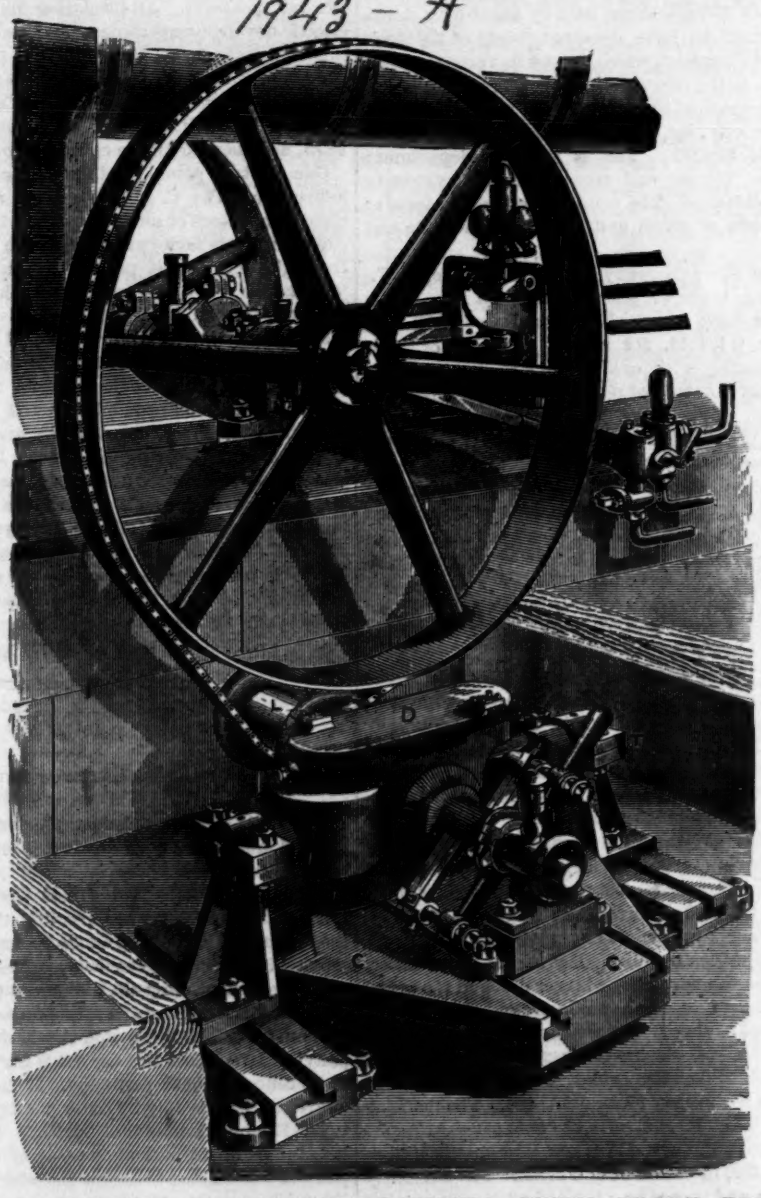


FIG. 2.—METHOD OF DYNAMO DRIVING WITH SHORT BELTS.

that half the weight of the armature and spindle, which is $\frac{94}{2}$ lbs., is born by the belt as well as the pulley itself, the weight of the pulley must equal

$$180 - \frac{94}{2}, \text{ or } 133 \text{ lbs,}$$

and a pulley of this weight was cast, and is at present in use on the dynamo at the Central Institution.

3 and 4. To determine the position in which the axis of the armature should be placed below and to one side of the axis of rotation of the flywheel, we have the condition that the horizontal components of the tensions on the two sides of the belt should be equal and opposite in order that there may be no side thrust. Hence, if α and β be

* Abstract of a paper read before the Soc. of Tel. Eng. and Elect.

the angles that the two sides of the belt make with the horizontal, Fig. 3,

$$P \cos. \alpha = Q \cos. \beta,$$

$$\text{or } \frac{\cos. \alpha}{\cos. \beta} = \frac{Q}{P} = 0.574.$$

And since the angle between the two sides of the belt is 100°,

$$\therefore \quad \alpha + \beta + 100^\circ = 180^\circ,$$
$$\text{or } \beta = 80^\circ - \alpha,$$
$$\therefore \quad \cos. \alpha = 0.574 \cos. (80^\circ - \alpha);$$

and expanding, we have

$$\tan. \alpha = \frac{1 - 0.574 \cos. 80^\circ}{0.574 \sin. 80^\circ} = 1.59;$$
$$\therefore \alpha = 57^\circ 50',$$
$$\text{and } \beta = 22^\circ 10'.$$

Plotting these results to scale, it is found that the distance of the centre of the dynamo pulley below the centre of the fly-wheel must be 2 feet 8½ inches, and the distance sideways 10½ inches, a result which is also confirmed by calculation. And this is the position in which the dynamo was placed some six months ago.

As a proof of the authors' conservative familiarity with the ordinary method of driving a dynamo, instead of with the principles of belt gearing, the first remark made by almost every one who has seen the new gearing is, that the belt must slip very much. As a matter of fact, however, so far from there being any serious slip, experiment shows that the dynamo, when giving out its maximum power, rotates a little faster than the calculation makes it, due, of course, to the diameters of the fly-wheel and pulley not being exactly as stated in the calculation.

We need not dwell here on the fact that ropes may be used instead of belts. Again, when a number of dynamos have to be driven from one fly-wheel in a confined space, one driving belt may be used for all, and, by means of guide pulleys, arranged so that each dynamo pulley lies on the belt between two guide pulleys, the part of the belt on one side of each dynamo pulley being nearly horizontal and on the other side nearly vertical.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Aug. 1, 1887.

The American Electric Light Company has decided to go out of business, if the case may be so stated—for, in fact, it had no business to go out of. The stock of the company consists of 10,000 shares of a face value of $50 per share, held by about fifty stockholders. Its assets appear to have consisted chiefly of the stock of the old Consolidated Company, which leased its various patent rights, properties, etc., to the Sawyer-Man Company.

The announcement is made of the formation of the Edison Wiring Company, of this city, by Mr. E. H. Johnson and others, with a capital stock of $50,000. This is the wire department of the Edison Machine Works, and the new move has already been noticed in these columns. The company will do business at 19 Dey street. All kinds of wires and cables will be made and supplied.

The Union Indurated Fibre Company, of Mechanicsville, N. Y., are now manufacturing tubes or pipes from wood fibre by a patent process. They have arranged with the Board of Electrical Control of this city, it is said, for a large quantity of these tubes, and are negotiating with one of the largest natural-gas companies for an extensive supply of pipes. The claims made for the pipe are very broad. Tests made in connection with the subway commission, now Board of Electrical Control, showed the material to have a tensile strength of about 1,100 pounds to the inch, and 2½-inch pipe will stand 80 to 100 pounds pressure to the square inch. The tubes are described as light, strong and cheaper than iron. They are made now in lengths of about 5 feet and threaded with the standard iron pipe thread, so as to be connected with iron pipe. Two and one-half inches is the smallest size now made, but the company will soon be in shape to fill all orders for any size from 2 inches up. As a non-conducter of electricity indurated fibre ware is said to stand high.

J. Robertson & Co., 129 to 131 Water street, Brooklyn, make a specialty of insulating and covering wires and cables with their system of lead covering for conduits, plain underground work and submarine use. Through the courtesy of Mr. J. Hardy, of the company, I was recently shown the process employed. For covering the wires with lead a hydraulic press is employed capable of exerting a pressure of several hundred tons. The insulated wire is guided through a die which fits it snugly and which ends opposite another die having a hole of larger diameter, equal to that of the lead covering intended. Between these two dies there is a space into which the lead is forced. It is poured into a receiver under the hydraulic ram while in a molten condition and forced into the space between the dies. Having no other outlet, it takes the path around the wire in the larger die and the pressure exerted not only forces the lead snugly around the wire, but also forces the latter out so that it requires no auxiliary drawing power. By the time the lead reaches the insulation on the wires it is comparatively cool, so that the insulation is not injured; and the wire is received on reels ready to be delivered. The machine is capable of covering 50,000 feet of wire or cable per day.

The Okonite Company, of Park Row, are now making lamp cord in all sizes called for, in cotton or silk braid. The flexibility of this cord is notable; and it can be obtained with any number of conductors. The Company are busy night and day on submarine and underground wires and cables for electric light telephone and telegraph supply.

I am glad to see that the paper recently read by Mr. C. A. Schieren on "Leather Link Belting" before the Technischen Verein of this city has been published in neat pamphlet form by his house. Although the subject is not an electrical one, the excellent paper on it touches some points that interest an electric light man and that might be followed up with profit. A copy of the pamphlet can be had by applying to C. A. Schieren & Co.

Mayor Hewitt, with the assistance of Mr. Gibbens, continues successful in fixing public attention on the proceedings of the "switchboard," and one great advantage gained from these discussions, repartees, passages of arms, and wordy fights, is that the public is being educated up to a clear conception of the great difficulties in the way of a complete, comprehensive, successful and satisfactory underground system. Mr. Mayor has gained one point, and that is, the placing of the employés of the "switchboard" under the local Civil Service Board. As it was desired to appoint a Mr. Cornell as an inspector without test as to his qualifications, this is regarded as one for the Mayor. Mr. Park Benjamin has been suggested as an adviser on certain technical details. I give the following as a sample of what is conducted through the switchboard:

Mr. Gibbens read a resolution reciting that it be the policy of the board and "its line of duty" to allow fair and free competition between electrical companies, provided the same can be done without any danger, pending the construction of the underground conduits.

"I move as an amendment," said Mayor Hewitt, "that all men shall do unto others as they would have others do unto them." [Laughter].

Mr. Gibbens was dumfounded.

"Do you mean that as an amendment?" he asked, and the question was repeated by President Hess.

"Certainly I do," responded the Mayor, "and I think it is entirely germane to the question. The resolution, as offered by Commissioner Gibbens, is simply a string of platitudes, and it is quite right that I should round it off by adding another platitude, and will put in the Ten Commandments if necessary."

"If the Mayor will withdraw his frivolous amendment," said Mr. Gibbens. "I will withdraw my resolution."

"You mean your frivolous resolution," insinuatingly remarked Mr. Hewitt.

"I didn't say my frivolous resolution, sir," replied the young Commissioner. "I said your frivolous amendment."

"This is the first time I have ever heard a remark of our Saviour termed frivolous," declared the Mayor.

"I said as an amendment," corrected Mr. Gibbens.

"The saying was an amendment to the old moral law," was the answer of the Mayor.

It was unanimously decided to delay action on all the applications and to have a tabulated statement made of the needs of all the companies. It will be noted that such play of wit does not promise a very early access to a comprehensive conduit system.

Looking in at the Kerite headquarters last week, I found Mr. Hotchkiss and his staff just as busy as though the office were next door to the North Pole, instead of being half a block from the Hudnut thermometer, then registering somewhere near 100 and only stopping at that point because it hadn't energy left to climb higher. The demand for kerite this season is brisker than ever, and the recent enlargement of factory and facilities already seem like half measures. An insulation that has seen all the various electric developments come up, with all their varying wants for small currents, large currents, high potentials and perfect conductivity and has been found in ever growing demand, is evidently somewhat of an insulation. The first wires, for example, put underground in Chicago, were some kerites laid as far back as 1875, and there are more called for to-day, twelve years later.

One or two points I gather on the motor business are quite interesting. The C. & C. Company are now putting in one of their own motors of much larger size than their ordinary make, to run their whole factory in South Fifth avenue. It will take current from the day circuit passing by the door, and thus they will "seethe the kid in the mother's milk." If any of your readers want to spend an hour in an instructive way, let them obtain permission to visit this factory. It will show them how the motor business is growing, and how thoroughly the specialization of productive effort is carried out in the most scientific manner. The same ideas and principles prevail here as in the largest factory for making sewing machines and for turning out thousands of watches daily—and I really don't know but that before long the motor will be running both the sewing machine and the watch pretty close in number. Another point about the motor business is that the extreme hot weather has created quite a demand for fans and ventilators run by motors, and that the severe losses being sustained by the street car companies, whose horses drop off daily by the score, is causing very serious attention to be paid by them to the claims of electricity. It is a poor sirocco that does not blow somebody good. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Aug. 1, 1887.

The Mather Electric Company's new factory at Manchester is finished, and it is reported that the company is now ready to commence manufacturing in its new quarters.

Advices from New Haven state that there is a rumor current there that negotiations are pending that will probably result in the Schuyler Electric Manufacturing Company, of Hartford, moving its factory and executive office to the former city.

At a recent meeting of the Lowell (Mass.) Board of Aldermen an agreement was read, and unanimously passed, between the Committee on Lighting and the Middlesex Electric Light Company, of Lowell, for 100 arc lights for three years from August 1, at 55 cents per light per night. If, however, 135 lights are used the rental will be only 50 cents per light.

The Boston *Commercial Bulletin*, July 30, contained the following: At an adjourned meeting of the Hartford Steam Company it was decided to accept the offer of the Hartford Light and Power Company, which agrees to lease the property for a term of years and guarantee yearly dividends of at least 1 per cent. on the stock and interest on the indebtedness of the steam company.

The New England Wiring and Construction Company, of Boston, has some of its large force at work at the factory of F. E. Reed, Worcester, Mass., putting in the wires for an increase of 200 incandescent lights of the Edison system. The same company has a number of men busily engaged wiring the Parker House, Boston, for the Edison system of incandescent lighting.

The Waterbury, Conn., Electric Light Company report in actual use 200 arc lights of the Thomson-Houston system and 500 Edison incandescent lights. Mr. Alden M. Young, the manager, informs me that his company has orders in hand for about 500 additional incandescent lights, and his men were at work putting in the wires for this increase as rapidly as possible.

The Naugatuck, Conn., Electric Light Company has now in use the arc and incandescent systems of the Thomson-Houston Company, 30 of the former lights and 150 of the latter. This electric light plant has been in operation only a few months, and to the enterprising Connecticut Electric Company, of Waterbury, belongs the credit of its installation. The steam department was equipped by M. J. Daly, of Waterbury, and it consists of a 60 h. p. Ball engine and a 75 h. p. Bigelow boiler. The officers of the company are: L. D. Warner, President; A. H. Dayton, Secretary and Treasurer; and Alden M. Young, of Waterbury, looks after the electrical and engineering departments, making occasional trips to Naugatuck for that purpose.

The Hartford, Conn., Electric Light Company began introducing the Thomson-Houston system of incandescent lighting direct from the dynamo about March 14, 1887, and as a gratifying result the number of these lights now in actual use is five hundred. Another incandescent machine of the same make has just been added to the electric lighting outfit of the Hartford Company's station, which will increase its incandescent lighting capacity to nearly 1,000 lights. The demand for incandescent lights in Hartford is steadily increasing, owing to the satisfactory results of the system above referred to. The post-office building is being wired throughout for the same illuminant, and it is estimated that upward of 300 lights will be used. The wiring and entire construction work for this installation is under the supervision of Mr. B. Willard, who has charge of all work in connection with the introduction of the Thomson-Houston systems of incandescent lighting in Hartford.

Among the shipments of feed-water heaters made by the Wainwright Manufacturing Company during the month of July, one was of 100 h. p. for an electric light plant in New York, and one of 300 h. p. to the Middletown Schuyler Electric Light Company, of Middletown, Conn. The Wainwright Company report business as very good and orders coming in daily.

Riley & Gray, of Boston, are very busy with orders for Howard & Bullough's electric stop motion drawing frames, the demand for which is constantly increasing. Steps are being taken to build these frames at about double the present rate in order to meet this demand and fill orders promptly.

The office of the Julien Electric Company for New England is located at 104 High street, Boston. O. E. Lewis is the resident agent and J. L. Kimball electrician. Mr. Lewis has had the Julien battery in his office during the past eight months running a machine for nailing soles on boots and shoes; a Simplex arc light, and various other apparatus. The claim is made that this—the Julien battery—is the first of the kind used for motive power for stationary machinery. From appearances it is a success for the purposes named, as well as for lighting buildings and railway cars. Mr. Lewis stated to me: "There has been no expense in keeping the battery in my office during the past eight months, save an expenditure of $1.50 per month in charging up the cells, which light the office and run the machine referred to."

Mr. Lewis also claims that he "is the first to light a house at the seaside with accumulators." With a battery of 24 of the Julien cells he has brilliantly lighted his cottage at Great Head, Winthrop Beach, Mass., every night from four to six hours during the past six weeks. The cells mentioned were charged at the Boston office June 15, and have not been recharged since that date. Mr. Lewis said that he has used two 16 c. p. and one 35 c. p. incandescent lamps constantly for the number of hours and during the time above mentioned.

On Saturday, July 30, about 40 of the Boston Electric Club had an excursion down the beautiful bay to Nantasket Beach, and after a very nice dinner at the Nantasket Hotel an informal or social meeting was held. There being present quite a number of the charter members of the club it was proposed that President Ridlow call up certain questions for discussion. It was decided upon to keep open the books for the registering of charter members until 30 days after the club became settled in its new quarters at No. 66 Boylston street, Boston. This would keep the books open until about Sept. 10. It was also agreed that the club should give a "house-warming" after a suitable time had elapsed from the date of moving into its rooms. Other matters looking to the advancement of the interests of the club were intelligently and harmoniously discussed; and after the adjournment the members filed out of the banquet room arm-in-arm and started for the steamboat landing, and all having the conviction that the trip down the bay had been productive of good results.

Mr. Charles L. Ireson, 97 High street, Boston, is now manufacturing a belt specially adapted for running dynamos, electric motors, fans, etc., etc., off high-speed engines, which merits attention and examination at the hands of the electric light people. This belt is known as "Ireson's self-adjusting link belting." Among the advantages possessed by this belt are its firm contact with pulleys and steadiness in running, which, of course, greatly increase its conveyance and steady delivery of power. Another good feature of this product is that no "air-cushion" is perceptible between the pulleys and belt. It is the intention of Mr. Ireson to have on exhibition at the Convention a number of his self-adjusting link belts in operation and members of the National Electric Light Association will find them worthy of inspection. Quite a number of electric light companies in New England are at present using the belt referred to and speak of it in highes terms.

The New England Pottery Company, of East Boston, Mass., reports being in receipt of an increased number of orders for its varied line of porous cells (or cups) for electrical appliances.

A new enterprise in the electric business of this city has just been started by the forming of a co-partnership of Kendall & Slade between Mr. Minott K. Kendall, who has been associated with Fuller, Holtzer & Co. for several years past, and Mr. Herbert L. Slade, late of the firm of Bates & Slade. They have taken offices at 43 Milk street, and at present are engaged in the manufacture and equipment of electric bells and annunciators, burglar alarms, watch clocks, electric gas lighting, etc., and propose later to enter into incandescent lighting. Being popular young men, with a large acquaintance among both the electrical and business fraternity, and backed by ample capital, it would seem that success is assured to them from the start, and it is hoped that they will receive the consideration merited by their enterprise.

The report comes from Holyoke, Mass., to the effect that "the Amherst Hydraulic Motor Company of that city has decided to close up its affairs, and has let the contract to manufacture the machines to the Holyoke Hydrant Company."

The Boston *Daily Globe* of July 29 contained the following ref-

erence to the American Bell Telephone Company: Bell Telephone dropped to 217. The instrument account is not so favorable as anticipated. Here it is :

Month, July 20.	1887.	1886.	Increase.
Gross output	4,345	3,279	1,066
Returned	3,196	1,382	1,814
Net output	1,149	1,897	*748
Since Dec. 20.	1886-7.	1885-6.	
Gross output	33,008	24,914	8,094
Returned	14,310	10,644	3,666
Net output	18,698	14,270	4,428

* Decrease.

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Aug. 1, 1887.

Messrs. H. M. Sciple & Co., the engine builders, Philadelphia, report trade with a very good general average. At present they are building a large steam plant at Shenandoah, Pa.—two 60 horse-power Ball automatic cut-off engines, and two 70 horse-power boilers—to be used in running electric machinery for town lighting, and to be completed in about three weeks. They have the contract for two 100 horse-power Ball engines for the Germania Brewing Company's new theatre building at Broad street and Columbia avenue, where they will run an Edison electric plant to light the brewery and Grand Opera-House. They also have the contract for five Ball engines—one 60 horse-power, two 90 horse-power, and two 100 horse-power—for Strawbridge & Clothier's new building at Eighth and Market streets. This will be the largest private electric light plant in the city, and one of the largest in the country. Orders are on hand for three smaller engines. Sciple & Co. speak very cheerfully of the prospect in general, and report indications for trade very good. They are bidding at present on three or four very large electric light plants soon to be erected in the city. The business of this year exceeds by four times that of last.

It has lately become known that a syndicate of Philadelphia capitalists, headed by Wharton Barker, and represented in China by Count Mitkiewicz, a Russian, have been granted the exclusive privilege for fifty years of constructing and maintaining a telephone service throughout the Chinese Empire. You have already made some note of this. This is the first privilege of the kind ever granted by the Chinese Government to foreigners, and Mr. Barker considers it the greatest concession ever made by any government.

The negotiations were made by Mr. Barker with the Chinese Minister at Washington and by Count Mitkiewicz, with Li Hung Chang, the Chinese viceroy. Government envoys empowered to close the contract will accompany Count Mitkiewicz to America.

It is said that the half dozen intimate friends whom Mr. Barker took into confidence advanced $10,000 each to stock the project. The Chinese Government agrees to take one-half the stock of the new company, and the Americans believe they have so good a thing that there will be no trouble in raising funds for the other half. A party of seven men, with wire and other material for a line of one hundred and sixty miles in length, is now at work in the empire, having sailed under the charge of Mr. Simon Stern in March last, via the Suez Canal, and the work will be pushed and the lines extended as rapidly as possible. A large European and American population, not only in the coast cities, but in the interior, is making such inroads upon the Chinese modes of business that the telephone has become a necessity. The company will be at liberty to use whatever kind of instrument it deems best, and as there are no Chinese patents the company will make its own instruments.

Mr. Barker was seen at his residence and interviewed in regard to the enterprise. Mr. Barker said : "Negotiations have been going on with this object in view all winter between the Chinese Minister in Washington and myself. It all grows out of a memorial presented to the Emperor by Viceroy Li Hung Chang some time ago, showing China's pressing need for European inventions and manufactures, and which also shows that the only feasible way for their adoption is by a partnership of foreign capital and skill, with the protection and support of the Chinese Government. After several conferences our syndicate was organized and we sent out a party of seven, who sailed last March for Shanghai. They took with them materials for the construction of 160 miles of long-distance telephone service, and were even prepared to make their own telephones. Simon Stern, of Philadelphia, was in command of the party, and Count Mitkiewicz had charge of the negotiations with the Government. Count Mitkiewicz cabled me about a week ago that the whole matter was fixed. I got a message from Li Hung Chang saying that the decree was signed. We will go ahead and build our plant and put up the wires. The scheme embraces long distance as well as local telephone service. A considerable European and American population makes this a necessity, and the 'advanced' Chinese population naturally will find telephones extremely useful. Count Mitkiewicz starts immediately for Yokohama to sail for the United States."

Mr. Barker declined to state who were in the syndicate, but said that all the money for the American half of the partnership would be furnished by Philadelphians.

The matter has created a great deal of discussion in financial circles. The Chinese Government, it is said, has actually purchased already half of the stock.

The first trial of the new electric motor car, which was made along Christian street and Gray's Ferry road last Tuesday afternoon, was a success. The car started from the old office of the Wharton Switch Company, at Twenty-third street and Washington avenue, filled with passengers, of whom many are prominent in the railroad world. Among them were S. S. Battin, president of the Consolidated Railways of Newark; C. B. Thurston, president of the Jersey City & Bergen Railway; Chief Engineer Nichols, of the Philadelphia & Reading Railroad ; Superintendent Crawford, of the New York Division of the Pennsylvania Railroad; Chief Engineer Brooks and Superintendent of Motive Power Hayward, of the same division; Professor A. Reckenzaun, of London.

The electricity was stored in eighty-four cells under the seats; its presence could not be suspected when the cushions were down. A Sprague motor swung below the forward part of the car. In front of the dasher was a large electric head-light. The car was lighted by incandescent lamps, and electric bells connected front and rear platforms. The batteries lasted four hours. Professor Reckenzaun, who had personally supervised the car's construction, said that it could go twelve miles an hour, and that electricity costs half as much as horse-power. The run was satisfactory in every respect.

J. J. Murray, of Gill & Murray, glass manufacturers at York and Thompson streets, has sold to his partner, Patrick Gill, his interest in the property at the southeast corner of York and Thompson, and also in that at the southwest corner of York and Moyer streets. The price paid was $25,550.

Mr. Gill will start his works in blast about the second week in August with a large lot of orders on hand, many of which are for electric light goods, of which the firm makes a specialty, and in which branch they are very largely interested.

The Wissahickon Electric Light Company has begun work on a two-story brick building at Cresson street, above Ridge avenue, in the Twenty-first Ward. The building is to be 30 feet by 44 feet.

The work of laying underground conduits for telegraph, telephone and electric light use was never so active as at present.

Permits were granted last week to the American Telegraph and Telephone Company to open the east side of Seventh street, from Walnut to Race; the east side of Tenth street, from Walnut to Callowhill, and the west side of Fifteenth street, from Walnut to Market; and to the Penn Electric Company to open the east side of Eleventh street, from Chestnut to Market streets, for the laying of underground conduits.

A permit was also granted to lay underground electric light wires on Front street, from Vine to South street, for the purpose of thoroughly lighting that portion of the city along the river front.

Patents were granted last week to Joseph Irwin, of this city, for an accoustic telegraph, and to Adolphus W. Schleicher, also of this city, assignor to Schleicher, Schumm & Co., for connecting engines and dynamos. Messrs. Schleicher, Schumm & Co. are the manufacturers of the popular Otto gas engine. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD, CHICAGO, July 30, 1887.

The lava insulators made by the D. M. Steward Manufacturing Company, of Cincinnati, have become deservedly and widely popular. Speaking on this subject recently, one of the members of the concern remarked: "We doubt whether anything in the electrical supply line has had such a growth as our insulator business, beginning only about two years ago. Since then we have twice outgrown our facilities for manufacture. We have added machinery until we are crowded for space again, and now contemplate a removal nearer the mines and the erection of buildings more than ten times the size of those we occupy. We have enlisted a large capital, and will shortly be able to fill orders of any size on short notice. As an illustration of the favor our goods are meeting with we will give you but a single instance. Less than six months since one of the leading electric manufacturing companies in the East ordered a hundred pieces as samples, then placed an order for 1,000 pieces, following it very soon by orders for 2,500, 5,000 and 10,000, and then fairly "took our breath" with orders for 25,000 pieces. When these were finished they telegraphed an order for 100,000 pieces, followed by a mail order for 25,000 of another shape. These orders were duly filled, and last week we were favored with their order for 205,000 pieces—all this in six months! Can you beat it? All this time scores of other concerns have not been unmindful of us, but have increased their orders until we scarcely know, in making an alteration or addition, if we can use it a month before it has to give place to something of greater capacity."

Not long ago this letter gave in detail a description of the tower plan to be adopted in New Orleans. The work is now beginning, and the city will have about 200 such towers carrying the various wires, 125 to 150 feet in the air. I hear that a similar plan is to be adopted for the city of Mexico.

A dispatch from Augusta, Ga., says that the heavy rains and floods there have caused an interruption in the work of preparing the grounds for the Piedmont Fair, and that the management proposes to make up lost time by putting on a large night force to work by the aid of the electric light.

There will undoubtedly be a large delegation from the West at the Boston gathering of the National Electric Light Association, and it would be even larger were it not for the fact that pressure of work keeps a number of gentlemen at their desks or in their works who would otherwise indulge in a brief vacation that so pleasantly combines business with enjoyment.

The following item from Cincinnati, about young Mr. H. B. Cox, is not without interest:

A young electrician living near this city has nearly perfected a trumpet to be used for telephoning at sea, on which he has been working for some months. The invention is the outgrowth of his discovery of the great distance an echoed or reverberated sound will carry and that speaking trumpets if made to give the same fundamental note would vibrate and produce the phenomenon known in acoustics as "sympathy." With this trumpet conversation in an ordinary tone of voice was carried on between persons four and a quarter miles apart. By listening to the whistle of a train and tracing it to and beyond Fernbank to Lawrenceburg, Ind., it was found that the instrument has a well-defined range of twenty-six miles; that is, a loud sound like a locomotive whistle or the rumbling of a train can be distinctly heard at a distance of thirteen miles in every direction. Conversation was readily carried on between two gentlemen on high hills on opposides of the Ohio River, about four and a half miles apart. Tests made on the water show that the trumpet was even more available there than on land. The instrument will be patented as soon as perfected.

Mr. F. W. Horne has resumed the position of Western manager for the Excelsior Electric Company, of New York. The Excelsior Company has already acquired an excellent standing in the West, and we here are all glad to welcome Mr. Horne, whose business ability and long experience are well-known.

For several years past there has been more or less discussion about underground roads for this city. The matter was brought up again this week by a company filing articles of incorporation and shortly afterward asking for a franchise from the City Council. The streets they propose to use are of sufficient width to permit of all necessary excavations without injury to the adjoining buildings, but it is difficult to understand how they expect to realize upon the enormous outlay required, as it is well-known the street car system of Chicago is well arranged, and the equipment sufficient to handle all the traffic offered. Their charter permits the use of electricity as a motive power.

The Central Electric Company have a finely equipped factory for the manufacture of pins and brackets, for telegraph, telephone and electric light purposes, at Columbia City, Ind., in the centre of the finest belt of white oak timber in the West. Mr. S. J. Peabody, the well-known hard wood lumberman, is interested with the Central Electric Company in this enterprise, and the quality of their goods is well known everywhere. Their trade is mostly by car-load lots. The daily capacity of this factory is 12,000 pins and 5,000 brackets. They own the sole right to use certain patented machinery, and that fact probably accounts for the superiority of their goods.

The Standard Carbon Company have arranged with the Electrical Supply Company of this city to handle their carbons, and a large stock will be carried on hand in Chicago.

The American Cushman Telephone Company state that no suit has ever been brought to an issue against them by the American Bell Telephone Company, and this statement applies to the individual users of their instruments. They claim that only upon one occasion was an injunction asked for by the Bell Company and that was at Findlay, Ohio, and that suit was dismissed without a hearing. They claim to have in use over six hundred instruments, that they are manufacturing them every day and selling them all over the country and are anxious to try their case. Mr. Hotchkiss, the assistant manager, is just the sort of a man it is difficult to keep down and the company seems to have substantial backing, and I judge the Bell Company will have more trouble with the Cushman people than perhaps any other company heretofore fighting them.

The electric light companies are busy figuring upon their proposals for the river lighting contract, and rumors of all kinds are afloat.

Mr. Chas. Truex, the new assistant general manager of the Electrical Accumulator Company, was a visitor to the city this week.

General Superintendent W. W. Smith, and Superintendent McDaniel, of the Missouri and Kansas Telephone Co., visited the city this week. "W. W.," as he is familiarly called, is still watching for the man who can tell him what electricity is, and in the meantime is making all the money he can for the Mo. & Kan. Tel. Co.

The following companies filed incorporation articles with the Secretary of State at Springfield, Ill.: The Union Passenger Railway Company of Chicago; capital stock, $1,000,000, to construct, maintain, and operate a horse, cable, electric or steam railway in the County of Cook; incorporators, James C. Page, Volna Parker Sherwin, and Frank F. Douglass.

Dental Electric Vibrator Company, at Chicago; capital stock, $100,000, to manufacture the dental electric vibrator; incorporators, L. W. Rood, J. Goodrich and A. Goodrich.

My correspondent at Salt Lake City, Utah, sends me the following: At Butte City, Montana, the electric light works and plant have been leased by John A. Tupper and H. M. Ogden, for a period of three years. Both gentlemen are practical electricians who thoroughly understand their business. They will proceed at once to put in the incandescent light in Butte. Mr. Tupper has been in the city several days perfecting the arrangement, and returned to Helena this morning to resign his position as superintendent of the Helena electric light plant there. Mr. Tupper was superintendent of the Brush plant at Helena, and Mr. Ogden represented the Thomson-Houston Company.

At a meeting of the City Council of Salt Lake City last week an application was made for right of way for an electric railway on Second South street from the Reservation to Second West street; thence to Hot Springs. The incorporators' names were not given, but substantial support has been secured.

My St. Paul correspondent sends me the following from a local paper :

There is said to be trouble brewing between the Bell Telephone Company and the Erie Telephone & Telegraph Company, which conducts the exchanges in Minneapolis, St. Paul and neighboring towns. Originally the right to use telephones in Minneapolis and St. Paul was obtained by R. H. Hankinson, John Watson, F. B. Jillson and Morris Towne, the franchise granted by the Bell Company being for eight years. Several years ago the Hankinson-Watson combination disposed of its interest to the Erie Telephone Company for $300,000. The contract between the Bell and Hankinson-Watson companies expired June 1 last. The Bell Company now claims that a new contract for eight years must be made with it by the Erie people at the rate of 30 per cent. of the earnings for eight years, which is estimated by well-informed parties at $200,000. The Bell company further claims that the contract in regard to the exchanges has been violated. Attorneys who have examined the matter claim that the Erie Company is without remedy and will be forced to submit.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following quotations upon telephone stock :

Bell of Mo.	$155@$157
Central Union	45@ 46
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	25@ 27
Michigan	76@ 77
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

C. H. M.

CLEVELAND, O., Aug. 1.

The new departure of the Standard Carbon Company, of Cleveland, naturally attracts much attention. Judging from the character of the men connected with this company it is one of the most important organizations in this line. The Standard Carbon Company is organized under the laws of the State of Ohio with a capital stock of $500,000. The officers are, president, D. A. Dangler, a man of great business ability and at the head of some of the largest enterprises in Northern Ohio. The superintendent

s Mr. W. H. Boulton, formerly of the Boulton Carbon Company, and a recognized pioneer and leader in this business, with Mr. H. A. Tremaine of the Cleveland Carbon Company, as assistant-superintendent; Mr. C. E. French of the Cleveland Carbon Company, secretary; W. G. Smith of the Crystal Carbon Company, treasurer, and Mr. J. B. Crouse of the Cleveland Carbon Company, vice-president, and in charge of the sales department. With such a combination of business ability and practical knowledge of the entire details of manufacturing, which can only be had by years of practical and actual experience, added to the large capital and immense works especially fitted with all the latest appliances capable of turning out from 150,000 to 200,000 carbon points daily, the customers ought to feel comfortable as to future supplies as well as price and quality.

I understand that the object of this company is to make first-class carbons and plates at a fair manufacturers' margin, claiming that with their immense facilities, and especially their practical experience, they will be able to manufacture better carbons and at less price than concerns with less experience and facilities.

Kansas City, July 30, 1887.

After a number of years spent in experimenting with electric railroad machinery, dynamos and motors, the Henry Company started their road in this city a few weeks ago, and continue in uninterrupted operation. The road is double track, one mile in length, extending from near the public square to Lydia avenue, on Fifth street. The street is very narrow, but 7 feet between the cars and curb line, and it is one of the important traffic streets of the city. The surface is undulating throughout, the heaviest grades approximating 350 feet to the mile.

The road is at present operated with four motor cars, each having a seating capacity of forty-two passengers, but they have frequently carried over one hundred on the cars. The motors weigh 1,200 pounds and are rated at 20 h. p. The conductors are overhead, and consist of four wires of No. 1 hard-drawn copper arranged in double multiple. They are supported over the track by means of thin metal loops attached to paraffined oak blocks, which in turn are guyed to posts at the sides of the street. The traveling contact consists of a carriage having grooved wheels which travel on the sides of the wire. The motor armatures revolve constantly at a speed of about 1,000 turns per minute. The speed of the car is varied at will by means of a single lever in the hands of the driver. The gearing, which affords a yielding leverage between the motor and car axle, runs in oil and promises to wear well. The station is filled up with two Ball 12 × 12 engines, one of which carries the heaviest loads with ease. It is said to be the intention of this company to extend their road to Pendleton Heights and run trains of two cars on 10 per cent. grades. A good portion of the machinery is now well under way. The company are also now equipping some roads in San Diego, Cal., and suburbs. On one of the roads a speed of a mile per minute will be attempted.

On the California roads the machinery and plans of the Kansas City roads will be followed except in the matter of conductors. Old railroad rails will be buried and insulated parallel with the track and connected at intervals with small overhead wires, thus affording a reinforced quantity current. The potential used at Kansas City is 250 volts. The entire system, including dynamos, motors, car mechanism and conductors, was designed by J. C. Henry. The armatures of the motors have never been hot, show no sparking at the commutators, and no light is visible on the darkest nights from the traveling contact or brushes. The armatures are wound with but a single layer of wire and show remarkable efficiency. The road has made money since it started, and the indications are the cost per passenger will soon be decreased to one cent per mile.

PACIFIC SLOPE NOTES.

San Francisco, Cal., July 23, 1887.

A company has been organized at San Diego to build a motor line from Upper Fifth street, San Diego, over the Mesa to El Cañon, 15 miles. The motive power will be electricity.

Articles of incorporation have been filed in the clerk's office at San Diego for the Elsinore Electric Railroad. It will be about 30 miles long. Rails have been ordered and work will be begun immediately.

Grading is nearly completed and the rails are being laid on the plaza in old San Diego for the San Diego & Old Town Electric road.

I suppose you have observed the incorporation of the Pacific Julien Company. We are going to see some storage battery business done here.

Engines for the Hotel de Coronado, Coronado Beach, San Diego, electric light plant, are now being installed.

The property holders on Telegraph avenue, Oakland, say they must have electric lights, even if they have to pay for them out of their own pockets. The city has contracted for gas, but that will not do.

At Oakland, on July 22, judgment was rendered in favor of the Western Union Company, restraining the Pacific Electric Company from erecting their poles on the same side of the street as the plaintiff, or in such proximity as to interfere with the transmission of messages. S.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 209 for August for $1 covers the death claims of W. D. Dunwoodie and C. D. Griggs.

Yuma to Ensenada.—Thomas G. Welles of the International Company of Mexico, now in San Francisco, states that his corporation has almost completed a telegraph line from Yuma to Ensenada.

Iron Poles for India.—An Indian railway company has ordered 250,000 iron telegraph poles 9 inches in diameter at the bottom and 2½ inches at the top, to be made in halves and screwed together with flanges.

Costa Rica.—It is stated that the government of Costa Rica, Central America, has been in correspondence with manufacturers in France relative to the laying of a submarine cable between Central America and New York City, touching at some of the West Indian Islands.

The Postal Company.—John Cummins, the receiver of the Postal Telegraph and Cable Company, made his report last week. He says that there was a balance in his hands July 20 of $18,276.27. The heaviest liability of the company is the mortgage to the Farmers' Loan and Trust Company of $10,946,291.24.

Altoona, Pa.—Bids for a complete fire alarm telegraph system were opened at Altoona, Pa., by H. T. Heinsling, city clerk, July 14, as follows: Richmond Fire Alarm Company, $5,290; Gamewell Fire Alarm Telegraph Company, $5,539; Union Fire Alarm Company, $5,835. All bids were rejected and new ones will be advertised for.

Across the Isthmus.—A special dispatch of July 26 from Panama says: "The Colombian Government has granted to the Central and South American Telegraph Company authority to establish and operate a telegraph line across the Isthmus of Panama, and to extend its cables from Colon along the Atlantic coast of South America."

The Proposed Hawaiian Cable.—The New York *Tribune* says editorially: Experience shows how convenient and desirable a cable to the Sandwich Islands would be. Its commercial value would also be considerable. All the same, it is not likely that the proposition of the San Francisco Chamber of Commerce, that the Government give substantial aid to the cable project, will receive general approval.

Jacksonville, Fla.—The Western Union Telegraph Company is now comfortably located in new quarters in Hubbard's new block, ground floor. This makes one of the finest-equipped offices in the South, greatly facilitating their ever-increasing business, besides making it the more accessible for the public where it is now located. B. F. Dillon, Superintendent; D. J. Crolly, Manager.—*Jacksonville Price Current.*

The Vermont & Boston Company.—A dispatch of July 27 from White River Junction, Vt., says: At the annual meeting of the stockholders of the Vermont & Boston Telegraph Company to-day the following directors were chosen: Norvin Green, T. T. Eckert, C. A. Tinker and R. H. Rochester, of New York; Thomas Roche and H. C. Sherman, of Boston; G. W. Gates and G. W. Smith, of White River Junction, and R. J. Kimball, of West Randolph. The directors subsequently elected Norvin Green president, Eckert and Tinker executive committee, and R. H. Rochester secretary and treasurer.

Licensing Telegraphers.—The Omaha *Bee*, a leading Western paper, gives its support to the movement for licensing railroad telegraphers, and says: "The organization may be assured that its efforts to bring about this meritorious arrangement will not lack public support, regardless of what other motives, if any, may be incidental to it, as the railroads will undoubtedly claim. A movement to effect the required improvement in this service, having once opened the eyes of the public to the great necessity there is for improvement, will receive such universal indorsement that resistance on the part of the corporations will be overwhelmed. We cordially commend the spirit and purpose of the railroad telegraphers, and would urge them to zealously push their plan, if it shall be found practicable, as we believe it to be."

Montreal Bucket Shops.—A special dispatch from Montreal of July 29 says: "The 'ticker' has been taken out of Messrs. Doran & Wright's office by the order of the Chicago Board of Trade, and that firm consequently has some difficulty in obtaining Chicago quotations. This action is in pursuance of the determination of the Chicago Board of Trade to crush out, if possible, the bucket shops, and is brought about by the refusal of the Chicago Board of Trade to furnish the quotations to the Western Union Telegraph Company should the latter continue to transmit them to the bucket shops. Considerable annoyance is expressed on the street here at the action of several members of the Stock Board who have been in the habit of filling orders at bucket shops instead of through recognized channels, and it has been proposed to introduce resolutions or frame by-laws preventing similar actions by members in the future. Legal advice has been obtained to the effect that the bucket shops here are illegal and can be prosecuted."

The B. & O. Deal.—The following statement is made by J. A. Hambleton & Co., the banking house of Baltimore in the confidence of the Garretts: "The agreement, as we understand it, between Messrs. Garrett and Ives was that the Baltimore & Ohio Company, telegraph, express and every other interest, was to be kept entire. Just here appears to have been the cause of the disagreement and failure of all negotiations. It is stated, and apparently the statements are at least to a certain extent worthy of belief and justified by subsequent developments, that one of the schemes of the Ives party to raise the necessary amounts to make the stipulated payments to the Baltimore & Ohio was to make a sale of the Baltimore & Ohio Telegraph Company to Mr. Jay Gould. Mr. Gould is reported as saying that Mr. Ives offered him the Baltimore & Ohio Telegraph for $3,500,000, but that he could not consummate the sale. From this it would appear that the Ives party attempted to make an unauthorized trade with Mr. Gould for the sale of the Baltimore & Ohio telegraph lines. Such a sale being in direct conflict with the terms of the agreement, Mr. Garrett promptly and decidedly refused to consent, and the Ives-Stayner deal fell to the ground."

THE TELEPHONE.

New England Telephone.—The usual quarterly New England dividend of ¾ per cent. has been declared.

Portable Telephone in Belgium.—According to long and somewhat startling cable dispatches in the papers, two Belgians, Colonel Renard and Professor Nothomb, have just made a "wonderful discovery," namely, a portable telephone. As portable telephones are somewhat familiar features of the telephone business, there does not seem to be anything so very "wonderful" in this discovery after all.

Washington Telephone Service.—The following comes from Washington: "The contract for the use of the telephones at the White House and in the Government offices expired on the 1st inst., and the President, after consulting with the members of his Cabinet, has decided not to renew the contract unless at a reduced rate. The present rate is $100 a year for each telephone. Letters have been addressed to the telephone company from the heads of the several departments stating that they would order the telephones out of the departments unless the company reduced the price to $80 a year. An officer of the telephone company said that they had no idea of reducing the rate to the Government, and would prefer to have their telephones removed rather than do so."

THE ELECTRIC LIGHT.

Napa, Cal.—A franchise has been granted to light Napa by electricity.

Port Townsend, W. T., now enjoys the advantage of the electric light.

Cardillac, Mich., is to have an electric light plant run by a 12 × 12 Ball engine.

Yazoo City, Miss.—The city has voted a sum of money for public electric lights.

Corsicana, Tex.—Work is being done on the incandescent station for Corsicana.

Mobile, Ala.—About $9,000 is to be spent in equipping the Mobile water-works with electric light.

Los Angeles, Cal.—The city is rapidly extending its electric light system, which seems to give much satisfaction.

Jackson, Tenn.—It is stated that Mr. N. A. Settle, of Clarksville, will probably erect an electric light plant at Jackson.

Sacramento, Cal.—The Capital Gas Company, Sacramento, Cal., have recently purchased a 50-light plant of the Waterhouse system.

Ludlow, Ky.—The National Electric Light Company, of Ludlow, Ky., has been organized with a capital stock of $650,000.

Spencer, Mass.—The Spencer Gas Company is placing at its gas works three 15 h. p. gas engines, with which to run its electric light plant.

Sale of Carbon Machinery.—All the plant of the Wallace Diamond Carbon Works at Ansonia, Conn., is to be sold at Ansonia on August 9.

Newark, O.—The Newark Electric Light and Power Company has been organized by W. F. Walworth and others, with a capital stock of $20,000.

Schenectady, N. Y.—The Schenectady Gas Light Company have ordered, through Mr. C. Levèy, 61 Broadway, another 35 lighter of the American system.

Philadelphia, Pa.—The Grand Opera-House, Philadelphia, is to be lit throughout by the Edison system. The steam plant will comprise two 13 × 12 Ball engines.

Belleville, Kan.—The Belleville Electric Light Company, which was recently organized, has C. Perry and others for incorporators. The capital stock is $25,000.

Laconia, N. H.—The Winnipesaukee Gas and Electric Light Company has applied for a charter and proposes to run electric light wires from Laconia to Lake Village.

New York City.—The Gas Commission has settled the form of contract to be made with electric light companies for city lighting, and will open bids for new service on Aug. 22.

Natchez, Miss.—The Natchez Cotton Mills Company has made a contract with the United States Electric Lighting Company for a plant of 250 incandescent lights.

Wytheville, Va.—J. W. Caldwell, H. B. Maupin, H. G. Wadley and Isaac Frank have been appointed a committee to contract for the construction of an electric light plant.

Hastings, Neb.—Mr. G. C. T. Hall is at Hastings, Neb., at work on a handsome central station of the Thomson-Houston system, and he expects to have 600 incandescents running by Sept. 1.

San Jose, Cal.—There has been a steady increase in the demand for electric lights at San José, Cal., and the Brush Electric Light Company there is now running to its full capacity, 110 2,000 c. p. lights.

Willimantic, Conn.—The Willimantic Electric Light Co., operating the Waterhouse system, have just increased their plant. They are supplying arc and incandescent from the same circuit with great success.

Norfolk, Va.—The Norfolk & Virginia Beach Railroad Company, C. W. Mackey president, and T. O. Troy general superintendent, is improving its property and intends to construct an electric light plant.

Chattanooga, Tenn.—The Hauss Electric Light Company has been incorporated by Hugh Whiteside, H. M. Wiltse, S. C. Frauerman, D. J. Hauss, T. M. Dillie, Julius Balke and Julius Balke, Jr., with a capital stock of $100,000.

The Jenney Electric Company, of Indianapolis, has sold, within the past fortnight, a 60-light plant to the city of Ypsilanti, Mich.; one of like size at San Bernardino, Cal., and has sold its plant at Alameda, Cal., to that city for $40,000.

Indianapolis, Ind.—The Union Railway Company has contracted with the Jenney Electric Company, of Indianapolis, for the apparatus for lighting the new Union station at that place. One thousand incandescent lights will be used in the main building and 60 arc lights for the tracks and sheds.

Sacramento, Cal.—The Capital Gas Company, which succeeded the Pacific Thomson-Houston Electric Light and Power Company, is now increasing its plant, and adding a 180 h. p. Corliss engine. Mr. J. D. Coleman is the superintendent of the electric light department.

Waltham, Mass.—The Waltham Gas and Electric Lighting Company, which has been in operation about six months, is now running two 200-light incandescent machines; one 45 light and one 50-light arc machines. It has two Armington Sims engines, and expects to put some motors in in the fall.

London, Ont.—The electric lights are now kept burning on the principal streets of the city from dusk till dawn, and those

who have occasion to be about during the "wee sma' hours" appreciate the convenience highly. A few more lights in the west end of the city would be acceptable.—*London, Ont., Press.*

Pullman Car Lighting.—It is hinted that Mr. Pullman is now paying great attention to the subject of electric train lighting, and that he proposes to adopt for all the Pullman cars a system of charging storage batteries from a small dynamo on each car connected up with the car axles. Mr. J. W. Hoffman, of the Pullman Company, is now at work on this system.

New Bedford, Mass.—A special despatch of July 29 from New Bedford, says: "It is rumored that the New Bedford Gas Light Company and the New Bedford Electric Lighting Company are to combine their interests, either by consolidation or by the purchase of the latter's property by the former. Meetings of the stockholders of both companies to consider the subject have been called."

Buffalo, N. Y.—A dispatch from Jamestown, N. Y., says: The Pennsylvania Gas Company and some of the citizens' committee have had a conference, the result of which is that the former have agreed to supply manufacturers with natural gas for fuel at 25 per cent. less than the cost of coal. The company will also give enough gas so that the Thomson-Houston Electric Light Company of Buffalo can have it at 50 per cent. less than the cost of coal, it being understood that that company would locate its works at Jamestown only upon condition of obtaining such a reduction.

Amsterdam, N. Y.—The Edison Electric Light and Power Company, of Amsterdam, J. X. Oatis manager and electrician, is now running some Simplex arc lamps on its incandescent system, and finds they give perfect satisfaction. The station is doing well, and is now putting in a new 150 h. p. boiler. It expects before the end of another year to have doubled its capacity all round. It is also installing an isolated plant of 300 lights in the Greene Knitting mills, one of 100 lights in the Clermont Mills, one of 100 in McCowett & Company's mill, and one of 25 lights in S. Sanford & Son's mill.

Vicksburg, Mo.—The Hill City Electric Light Company, J. B. Mattingly president, and J. H. Avritt superintendent, went into operation on the 9th of June last, with 20 lamps in circuit. It is now running 104, and has about 30 orders to fill. It has one 45 and two 30 light Thomson-Houston machines. Forty-one lights are used for street lighting under a three years contract at $14 per lamp per month. There are 44 lamps on the regular commercial circuit at $12 per month. Mr. Avritt will shortly put in a Westinghouse alternating current machine. Vicksburg is a city of 13,000 population, and is showing itself more and more appreciative of the advantages of the electric light.

Manitou Springs, Col.—On Tuesday, July 19, the incandescent lights at Manitou Springs, Col., were turned on, and the system was found to be perfect, with an uniform and equal pressure on all the circuits. The station is owned and operated by Dr. W. A. Bell and Capt. H. H. Brown and son. The plant comprises one 30 light arc and two 250 light incandescent dynamos of the Thomson-Houston system. The power is derived from a newly devised water motor, with two 10 inch wheels, 4 inch face, which, with a head of water of 84 feet in an eighteen inch pipe, is supposed to give 115 horse-power. The water is brought through a half mile of flume from a dam at the Ute Pass, to a penstock 84 feet higher than the motor, which it reaches through a wrought iron pipe. It is said that a steam engine will be added at an early day, and the plant enlarged to keep pace with the growing demand for the light.

The Standard Carbon Company.—It is stated that the new Standard Carbon Company, comprising the Boulton, Cleveland and Crystal companies, has an authorized capital of $500,000 and a paid up capital of $150,000. In an interview with a Cleveland *Plain Dealer* reporter, Mr. Boulton is quoted as saying: "The Pittsburgh Carbon Company sold for whatever price it could get and the other members of the pool thought best to break up the united companies, and therefore asked the court to appoint a receiver. The price that Mr. Hawks placed on carbon—$20—was too high, and I thought so at the time; $12 or $14 a thousand is plenty. The price also depends on the quality of the carbon. The Boulton Carbon Company always manufactures the best and I don't care if some firms sell for $5 or $6 a thousand, I can get a good price."

Woodbury, N. J.—A correspondent of the Philadelphia *Record* says: "Gas, water and electric lights are three things which the people think much of, and which they have in abundance. Oddly enough, they began at the end and worked backward when they introduced these luxuries. First came the electric lights. Three years ago the Woodbury Electric Light and Power Company was organized, a Thomson-Houston system was established, and now there are forty-five arc lights strung across the streets, lighting the city in a rare manner. The company makes no money, as it charges the city but $85 per year for each lamp, which is less than half of the lowest rate paid by the city of Philadelphia. Plenty of lights in the street created a cry for more light indoors, and a gas company was formed a year ago with $45,000 to begin work with, and now the houses have been lighted by gas for about two months."

APPLICATIONS OF POWER.

Rochester, N. Y.—The *Pythian Knight* is now being printed in Rochester, N. Y., by electric motor.

Mansfield, O., has received its first Daft car, and the work of getting ready for operation is almost entirely done.

An Alternating Motor.—It is understood that the Westinghouse Company will place an alternating current motor on the market this season.

Asbury Park, N. J., has just received some of the Daft generators for its electric road, and the first cars will soon be ready to ship from the factory.

Bethlehem, Pa.—The Bethlehem Electric Light Company has not yet gone into the motor business, but proposes to do so this fall. Mr. G. W. Walker is the superintendent.

Detroit, Mich.—The Highlands Park road now has four cars running, the "Ampère," "Volta," "Franklin" and "Faraday," equipped with Fisher motors and doing good service. The two latter cars, recently placed in service, have the motors on the front platform.

Gloversville, N. Y.—The Gloversville Electric Power and Light Company has just started in the motor business, the glove work in the town promising a good field for the use of motors.

Los Angeles, Cal.—The Elsinore Lake Shore Electric Railway Company has now been incorporated, and will proceed to build an electric road around the lake, a distance of 30 miles.

Oskaloosa, Ia.—The Oskaloosa Gas Light Company has placed three 10 h. p. Hawkeye motors on its incandescent circuit—one in a printing office, one in a saw-mill and one in a restaurant.

Hutchinson, Kan.—The Hutchinson Water, Light and Telephone Company has in use on its incandescent circuit one 5 h. p. Sprague motor running a daily newspaper press at $45 per month.

San Jose, Cal.—It is stated that the Fisher system has been adopted for an eight-mile conduited electric railway between San Jose and Santa Clara, eight motor cars to be used, each hauling two cars.

San Francisco, Cal.—J. M. Davies and J. L. Wetmore have applied to the City Council for a franchise to build and operate an electric or cable road on Franklin, Twentieth, Webster and Locust streets.

Providence, R. I.—The Narragansett Electric Light Company is putting up an independent circuit for motors only, and is already placing about 30 h. p. of Thomson motors. It will charge $120 per h. p. per year.

Reading, Pa.—The Reading Electric Light and Power Company has placed a C. & C. ⅛ h. p. motor on its incandescent circuit for dental purposes, under a yearly contract at $2 a month. The motor is reported as giving perfect satisfaction.

Abilene, Kan.—The Abilene Water and Electric Light Company is not running any day circuits, but has one motor on its night incandescent circuit, which is used for the printing press of the morning paper. Forty-five dollars per month is charged.

Boston, Mass.—The Board of Aldermen has passed an order allowing the Cambridge Street Railway Company to establish and maintain electric motive power for propelling its cars on North Howard street, from Western avenue to Cambridge street.

San Francisco, Cal.—The California Electric Light Company, Mr. G. H. Roe, secretary, has put in a motor plant, but has been a little delayed in getting it started. The motors will be run on an independent circuit, and the current will be furnished by special generator.

Cleveland, Ohio.—The Cleveland Electric Light Company is running four Cleveland motors on its incandescent circuits and twelve on its arc, from one to four h. p. each, operating coffee mills, ice cream freezers, etc. The rates are $8 per month per h. p. The company is also running 24 sewing machine motors at $1 each per month, ⅛ h. p. each.

New Orleans, La.—The Edison Electric Illuminating Company of New Orleans, W. T. Mottram, superintendent, has already put on its circuits, within the last 3 months, fifteen ½ h. p., three 1 h. p., three 5 h. p., one 10 h. p., one 15 h. p. Sprague motors, and ten C. & C. ⅛ h. p. These motors are running printing presses, elevators, shirt factories, fans, sewing machines, etc.

St. Paul, Minn.—The Edison Electric Light and Power Company, of St. Paul, has put on its incandescent circuits four ⅛ h. p., two 2 h. p. and four 3 h. p. Sprague motors, supplying power for coffee mills, sewing machines, elevators and printing presses. The rate charged is $8.50 per h. p. per month. In each instance the purchasers speak in highest terms of the work done by their motors.

Galveston, Tex.—The Brush Electric Light Company, Galveston, has in use eight Brush motors, from 1 to 14 h. p., on a motor circuit of 10 ampère current. These motors are running printing presses and ventilating fans, and are also in the service of the Moxie Manufacturing Company. Mr. W. S. Hipp, the superintendent, reports that they are giving great satisfaction. The rate charged is $15 per month per h. p.

Pawtucket, R. I.—The Pawtucket Electric Light Company has in use on its 110 volt incandescent circuit three 1½ h. p., three ⅛ h. p., one 1 h. p. Thomson-Houston motors and three ⅛ h. p. C. & C motors. These are running printing presses, lathes, coffee mills, fans, sewing-machines and stone-cutting and polishing machines. Where the motor is sold $100 per year per h. p. is charged; where the motor is rented, $150 a year.

Lowell, Mass.—The Middlesex Electric Light Company has placed on its incandescent circuit five Thomson-Houston motors, three of 1 h. p., one of 3 h. p. and one of 7½ h. p. The 1 h. p. motor is used to blow an organ and two 1 h. p. are employed on ice cream freezers, with fan attachment. The 3 h. p. motor runs the printing presses in the office of the Lowell *Daily News* and the 7½ h. p. runs the presses for the Lowell *Daily Courier*.

Boston, Mass.—The Boston Electric Light Company has in use on its arc circuits nine 1 h. p. Baxter motors, ten 2 h. p. Weston, and one ½ h. p. C. & C. These motors are employed on fans, sewing-machines, printing presses, lathes, coffee mills, etc. The customer buys the motor, and 50 cents per day per h. p. is charged. All are reported to be giving satisfaction; the 1 h. p. Baxter motors are said to be doing their work admirably.

Omaha, Neb.—The proprietors of the Omaha Street Railway had it in contemplation not long since to adopt the cable system. It is understood, however, that the idea has now been abandoned except possibly in the case of one line. The street railway people believe in the superiority of the electrical system, and think it will soon reach commercial perfection. The probabilities are that at no distant date, all the horse car lines in Omaha will be run by electricity.

Auburn, N. Y.—The Auburn Electric Light Company is already giving the motor business a good trial. It has four motors in use on its arc circuits, all working handsomely with the result that there is a steady increase in the demand. One 6 h. p. No. 4 Brush is running a cap factory, doing a variety of work. One ¼ h. p. Cleveland is employed on a coffee mill, and two C. & C. motors are used by the Artist Copying Company to throw colors on photo-portraits. One hundred dollars per year per h. p. is charged on the average. The coffee mill is run at $2.50 per month, and $1.50 per month is charged for the portrait work.

Providence, R. I.—The Rhode Island Electric Lighting Company, J. I. Drake superintendent, using the United States system, is furnishing 3 h. p. for motive purposes, using not a regular motor, but an old 30-light incandescent machine, running on the arc circuit. The company has not yet made a business of this line of work and only furnishes this service as a matter of accommodation. The motor is located in a small shoe factory, and $125 per h. p. per year is charged.

Baltimore, Md.—The Brush Electric Company, of Baltimore, has no fewer than 60 motors on its circuits. These are all of the Baxter make, and range from ⅒ to 10 h. p. They are employed in running printing presses, sewing-machines, lathes, coffee mills, fans, etc. The rates charged are $10 per h. p. per month for all above and including ½ h. p., and somewhat higher for the smaller sizes. The demand for the motor is steadily increasing, and the satisfaction is general.

Cheyenne, Wyo.—The Brush-Swan Electric Light Company, of Cheyenne, has in use two Griscom motors, three 1½ h. p., made by themselves, and one 1½ h. p., made by S. H. Short. These are on incandescent circuit, which during the day is fed by storage batteries and at night direct from the dynamo. Two of these are on sewing machines, one on a sausage machine, one on a printing press and two in machine shops. The motors are sold to the customers, and 10 to 15 cents per h. p. per hour is charged.

Trial Trips in Philadelphia.—Last week another successful run was made by Messrs. William Wharton, Jr., and A. Reckenzaun, with the storage car which they have equipped there, carrying a Sprague motor and a set of 84 Electrical Accumulator storage cells, each weighing about 40 lbs., and placed under the seats. The car carried an electric headlight and 4 incandescent lamps, as well as electric bells. The trips appear to have been very successful, lasting some time, and the speed attained being 12 miles an hour.

Middletown, Conn.—The Middletown Electric Light Company, D. W. Northrop, president, and J. P. Stow, general manager, is now erecting a brick building 75 ft.x110 ft., where it will begin the incandescent lighting business, its present quarters being too small for the purpose. As soon as it gets into its new station it will also go into the motor business. It already has contracts for 9 Sprague motors, which it will run on its Edison incandescent circuit, in three candy and ice-cream stores, two machine shops, two carpenter's shops, and two grocery stores. The company will be ready for its incandescent business about Sept. 1st.

The Overhead Conductor Company.—Articles of association for the Overhead Conductor Electric Railway Company, of Pittsburgh, have been filed. The company is organized for the purpose of purchasing, holding and selling of patent rights for electric railway purposes, with the right to issue licenses for the same and receive pay therefor. The capital stock is $300,000 in 6,000 shares, divided as follows: George Westinghouse, Jr., 1,200 share; John Caldwell, 200; Herman H. Westinghouse, 200; F. L. Pope, 800; Thomas B. Kerr, 1,200; Thomas B. Kerr, trustee 2,000; George H. Christy, 180; Caleb H. Jackson, 200, and R. H. Whittlesey, 20 shares.

New York City.—The North and East River Railway Company, which has laid double tracks on Fulton street, has secured permission from Arthur Leary, president of the Bleecker Street Railroad Company, to relay the tracks of the latter company on Fulton street. When this is done the electric conduit, which is now in process of construction at Pittsburgh, will be put in place. The stationary engines and boilers are ready and awaiting shipment from Providence. J. G. Brill & Co., the car-builders, of Philadelphia, have notified the company that the twenty cars they ordered some time ago are almost ready, so there will be no delay after the tracks are ready. The Eighth Avenue Railroad Company and the Belt Line Company have given the electric company the right to run cars over their tracks on Fulton and West streets.

In the Lykens Valley Coal Mines.—The Union Electric Company, through its electrician, Mr. W. M. Schlesinger, has made a successful electric railway installation in the Lykens Valley, Pa., coal mines. The track is wholly within the mine, and is about 6,000 feet long. It includes a 25-foot curve and a 30-foot curve. The grades in most cases are slightly in favor of the load, but there are many places entirely level, and long stretches of uphill work, one grade of 1½ per cent. being reached just in front of the 25-foot curve. The first run in was made last week. The motor met a loaded train coming out; the mules were taken off the cars and the motor then hauled them easily the rest of the way out—1,800 feet. Next day the train hauled out the load. The entire train weighed 112,000 pounds. The road appears to be highly thought of by practical miners.

PERSONALS.

Mr. Isaac Harlow, formerly cashier of the Western Union Telegraph Company in Boston, died on July 29, seventy-six years old.

Mr. H. B. Cox, the Cincinnati electrician, is credited with having made recently some very important improvements in the field of sea telephony.

Mr. J. F. Kelly, a gentleman very well known in electrical circles in New York City, has been placed in charge of the office just opened at 19 Dey street, of the wire department of the Edison Machine Works.

Mr. W. Hubbard, of Elgin, Ill., has resigned his position in connection with the telephone exchange there. He has been its manager since it was built in 1881. He is now devoting his attention to general electrical work and more especially to the well-known Elgin acoustic, which is his invention.

Mr. Frank E. Fisher, of the Detroit Electrical Works, is receiving considerable attention from the Detroit papers since his electric railway worked so successfully. He is not yet 28 years of age, but has already, it is said, some fifty inventions and ingenious devices to his credit, including an annunciator, telephone exchange details, electric motor, induction coil, magneto

door pulls, cash carrier system, electric clock push button and a machine for making insulator pins. He has been connected with the works since he was sixteen years of age.

Mr. Joseph Wills, on leaving Auburn, N. Y., recently, was presented by his many electrical acquaintances there with a beautiful silver gold-lined water set, bearing the inscription: "Presented to Joseph Wills, July 1, 1887, from his electrical friends." He is now at Norfolk, Va., assisting the Electrical Light Company, of Virginia, to get things in good shape there, the company having secured a renewal of the street lighting contract. Mr. Wills has lately been successfully at work on a new electrical recording gauge for steam power and heating systems.

MISCELLANEOUS NOTES.

Buffalo, N. Y.—A brick conduit for underground wires, 8 × 6 feet, is to be built in Buffalo, with smaller connecting conduits of cement.

The Commercial Electric Company, of Camden, N. J., has been incorporated by A. J. Congdon and others, with a capital stock of $200,000.

The Automatic Electric Alarm Company, of Camden, N. J., has been incorporated by C. J. Hexamer and others, with a capital stock of $25,000.

Minneapolis, Minn.—The directors of the Minneapolis Exposition are considering the advisability of requesting Mr. Gladstone to open the exposition this year by pressing an electric button in London, as Mrs. Cleveland did in Washington last year.

A Water-Gas Association.—It is proposed to form a national association of water-gas engineers and superintendents. Preliminary steps have already been taken, and a circular on the subject has been issued. Mr. E. C. Brown, editor of the *Progressive Age and Water-Gas Journal,* has consented to act as temporary secretary pending the final organization, and any details desired on the subject can be obtained from him.

The American Institute Electrical Exhibition is in excellent shape, and already promises to be a great success. Not only have a large number of new applications been made, but some of the earlier applications have been increased—one, for example, from 75 square feet to 400. A great many novelties never before shown will be included in the exhibition. All who desire space should lose no time in applying at once to Mr. J. Wetzler, secretary of the New York Electrical Society, 175 Potter Building, New York.

Storage on the Pacific Slope.—Articles of incorporation of the Pacific Julien Electric Company have been filed with the County Clerk, San Francisco, Cal., the object of the corporation, as set forth, being "to engage in the business of electricians in every branch, manner and kind of such business." The capital stock is $1,000,000, divided into 10,000 shares. Directors and incorporators: Irwin C. Stump, James H. Robinson, H. B. Land, E. W. Lesser and Fred M. Pickering, each of whom have subscribed for ten shares of the stock.

The Hartford Dynamic Company, of which mention has already been made, has Prof. C. K. Wead, late of the University of Michigan, as its president, and Mr. H. M. Linnell as its general manager. This is a strong team and should give the company a leading position in its special field of work, that of furnishing central and isolated equipments and discharging the duties of what may be called consulting electrical engineers. Mr. Linnell has already installed some fifty plants, all of which may be taken as samples of the work that the new company will do. Besides paying special attention to engineering features of the work, the Dynamic Company will purchase supplies, undertake repairs, and be ready at all times to furnish trustworthy information on all technical matters connected with steam and electricity.

Determination of Longitude.—Edwin Smith is occupying the Longitude Station in Lafayette Park, San Francisco, for the determination of the difference of longitude by telegraph between the station there and that at Portland. After this work is completed the further telegraphic work will be the determination of the difference of longitude between Portland and stations at Port Townsend, Tatoosh Island Light, Pendleton, etc. The Western Union Telegraph Company, with their usual interest in this work, have extended every facility to the Coast Survey parties, and their officers recall the yet unsurpassed feat of Professor Davidson in sending the clock signals from the station in San Francisco to Cambridge and back, through 7,200 miles of wire and twelve batteries in line.

Misrepresentations Refuted.—The following, addressed to the Boston *Herald* by the Callendar Insulating and Waterproofing Company, explains itself: "In your issue of the 20th inst. you publish a dispatch from New York stating that the Boston committee on underground wires had visited Washington and found that the underground electric light wires there had proved a failure. Such is not the case, and every statement made by your correspondent is directly the opposite of the truth. The cables were laid two years ago and to-day are in daily use. The insulation is neither paraffine nor rosin, but bitumen. The cables were manufactured in Newark, N. J., and are not English; they were not laid in winter, but in summer, and they were embedded in asphalt. They were laid by our company. It has also some of its underground cable in successful use in this city, as well as in eleven other American cities, and it is now manufacturing complete underground plants both for Columbus and Grand Rapids."

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Wainwright Heaters.—A full description appeared in these columns a short time ago of the electrical plant recently erected in the house of Mr. E. H. Johnson, president Edison Electric Co., at Greenwich, Conn. The article stated at the time that no pains had been spared to make this a model plant, and therefore it is no small testimony to the merits of the "Wainwright" Heater that it was preferred for this location.

A Boston Exhibition.—Our readers will observe in another column the announcement of the exhibition of the old Massachusetts Charitable Mechanics' Association, which opens Sept. 27. This is an excellent opportunity for manufacturers of electrical machinery, appliances and supplies to show their goods. This association has an abundance of power in their big building in Boston, and will have in their fair many machines for which motor power will be needed. They will also gladly welcome everything in this line which is sent, as they propose to "keep abreast of the times" in showing the people the lastest advances in scientific mechanics. But no time should be lost in securing space.

Roller Chain Belting has of late found a new and extensive use in connection with electric railways, being used with sprocket wheels for transmitting power from the armature of the motor to the car axles. This business is receiving the special attention of the Roller Chain Belting Company, of Columbus, O., who are the sole manufacturers of the Legg roller detachable chain belting. Great wearing surface, strength and durability are claimed for their chain belt, which is detachable in every link, develops little friction, and runs in either direction equally well. The company will be glad to furnish estimates for electric car equipments, and for any other work in their line.

SPARKS AND FLASHES.

To Prevent Cackling.—There are 60 electric bells on W. K. Vanderbilt's farm. Whenever a hen lays an egg she is required to touch one of these bells instead of cackling. It answers the same purpose, and is a great saving of energy for the hen.—*Burlington Free Press.*

The Man in the Telephone.—A young child stood watching a person talking into a telephone transmitter in Holliston on a recent occasion, when suddenly it said to the lady: "Who are you talking to?" "To a man, my child," responded the lady. "Well," said the child, "he must be an awful cunning little man to live in such a small house as that."

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

Aug. 2, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	25	35
Am. Tel. & Cable	70½	73
Cen. & So. Am.	.....	.....
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	75	80
Pac. & Atl.	.....	.....
*Postal T. & C.	20	30
South. & Atl.	.....	.....
W. U. Tel.	70⅛	70¼
W. U. Scrip.	.....	.....
W. U. Bonds	116½	.....
Mut. U. Bonds	85	85½
TELEPHONE.		
Am. Bell	201	202
Am. Speaking	110	120
Erie	31¼	32
*Hudson River	.....	58

TELEPHONE.	Bid.	Asked.
Mexican	1¼	1¼
*N. Y. & N. J.	.....	90
N. Y. & Pa.	.....	.....
New England	42	42½
*Southern Bell	125	135
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill.	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	.....	.....
*Edison Ill	.....	.....
*Edison Isolated	.....	.....
*United States	.....	.....
*U. S. Ill.	.....	.....
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

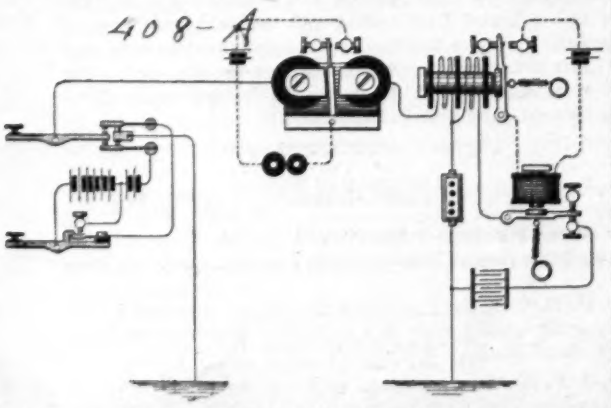
PATENTS DATED JULY 19, 1887.

366,660. Electric Boot-Blacking Apparatus: H. R. Gardner, of Boston, Mass. Application filed April 6, 1886. For description, see this issue, page 64.

366,821. Apparatus for Measuring Electricity; G. Forbes, of London, County of Middlesex, England. Application filed March 10, 1887. For description, see this issue, page 68.

366,654. Electric Bell Coupler for Steam Railroads; J. M. Duby and J. L. Edmester; J. M. Duby, of Medford, and J. L. Edmester, of Chelsea, Mass. Application filed Jan 8, 1887. The parts of this device may be uncoupled by hand without breaking the circuit, but when pulled apart by accident the circuit is broken and an alarm sounded in the engine cab.

366,673. Device for Holding Incandescent Lamp Filaments while the same are being Flashed; H. Lemp and W. J. Wightman, of Hartford, Conn., Assignors to the Schuyler Electric Manufacturing Co. of Conn. Application filed Aug. 19, 1886. Structural details relating to devices for holding the filament, and means by which a greater amount of carbon is deposited near the ends of the filament.

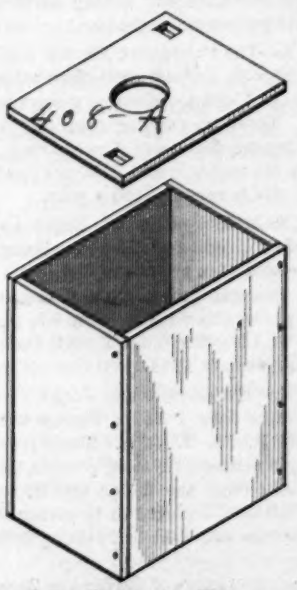


366,695. QUADRUPLEX TELEGRAPHY.

366,695. Quadruplex Telegraphy; Gerritt Smith, of Astoria, N. Y., Assignor to the Western Union Telegraph Co., of New York. Application filed Jan. 2, 1885. In this system one message is transmitted by a pole changing key, and is received upon a polar relay. A second message is transmitted by adding and removing battery, and is received upon a neutral relay. See illustration.

366,717. Inclosing Cell for Electric Batteries; Camille A. Faure, of N. Y. Assignor to the Electrical Accumulator Co., of same place. Application filed April 1, 1887. This is an acid proof cell for secondary batteries of sufficient mechanical strength to permit of transporting the plates or elements in position in the cell without injury to the walls thereof. See illustration.

366,777. Voltaic Belt; C. B. Judd, of Council Bluffs, Iowa. Application filed Aug. 26, 1886. The plates are coupled together without hinges, but in a manner to render the belt flexible.



366,717. INCLOSING CELL FOR ELECTRIC BATTERIES.

366,811. Combined Street Railway Rail and Conduit; G. C. Bolgiano, of Baltimore, Md. Application filed Jan. 25, 1887. The rail constitutes the cover of a metallic trough in which lie the conductors.

366,898. Insulating Compound; James Tatham, Philadelphia, Pa. Application filed Nov. 20, 1886. An insulating compound consisting of rosin and cotton-seed oil, in the proportions of from 4 to 6 parts by weight of rosin to 1 part of cotton-seed oil.

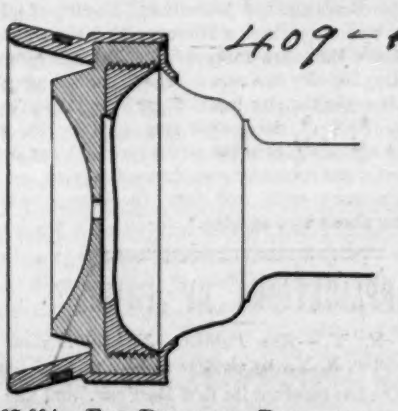
366,938. Electric Arc Lamp; S. Doubrava, of Prague, Bohemia, Austria-Hungary. Application filed Aug. 25, 1886. The arc is regulated by a movable solenoid, movably suspended in the field of a fixed magnet, the solenoids being in an electric bridge between a resistance and arc lamp on one side of a split circuit and two resistances on the other side.

366,941. Dynamo-Electric Machine; J. W. Easton, of N. Y. City. Application filed Sept. 4, 1886. The end plates of the machine are partly of cast and partly of wrought iron.

366,970. Telegraph Instrument; W. A. Melbourne, of Swanwick, Assignor of one-half to Simon R. Burton, of Belleville, Ill. Application filed March 1, 1887. A slide or switch is used whereby two independent main lines may be separately connected with the same sounder, key and relay.

366,994. Attachment for Telephones; T. C. Bradford, of Cincinnati, Ohio. Application filed April 16, 1887. See brief of No. 367,003.

267,002. Electric Lamp; C. A. Homan, of Winchester, Mass., Assignor, by direct and mesne assignment, to Lydia K. Homans, of same place; O. F. Ganz, of Rutherford, N. J., and A. L. Beaza, of New York City. Application filed July 19, 1886. These improvements are for facilitating the work of removing and adjusting the carbon electrodes.



367,004. EAR PIECE FOR TELEPHONES.

(1) 367,003. (2) 367,004. Ear Piece for Telephones; G. A. Huewe, of Cincinnati, O., Assignor to T. C. Bradford, of same place. Application filed Jan. 15, 1887. These are flexible elastic rings, inserted around the receiver to rest against the head, and preclude all external sound. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.